the OIL AND GAS JOURNAL
PUBLISHED WEEKLY MAY 23, 1960

GOT MONEY TROUBLES?

Small Business Administration loans are available to oil men, too... p. 72

What are crude oil's real competitors? ▸ 61
Natural gas, imports, and changed yield patterns are hurting crude producers, Journal study shows

Sextuple completion slashes costs ▸ 66

Big flood planned in Aneth area ▸ 78

Tips on selecting gas turbines ▸ 107

FOSSIL FUELS FOR FREEWAYS

The busiest traffic arterial in the world is the Freeway system. Millions of motorists use these Freeway engineering achievements each day, as the most advanced intra-city type of highway system in the free world . . . to work . . . from work, and on business.

Millions of gallons and pounds of petroleum products are consumed each day, used up, ridden on, handled over this traffic artery, *and still the need keeps growing.*

To back up this and other areas of petroleum products consumption is the responsibility of the entire petroleum industry.

"Produce more so we can use more" say 120 million car riding Americans who pay silent tribute each day to the fact that the better way of life stems from petroleum.

Our responsibility to these car riding Americans is, and will continue to be, as a partner of the petroleum industry, to help you find and produce the products this moving traffic world needs and uses.

We'll be here to answer the challenge.

HALLIBURTON OIL WELL CEMENTING COMPANY
DUNCAN, OKLAHOMA

OIL AND GAS JOURNAL
Vol. 58, No. 21

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TECHNOLOGY—OPERATION

Refining-Processing

Laverne Gas Products Plant Has Interesting Features 86

By William T. Lawler

The new 150-M.M.c.f. per day plant features gas-turbine-powered generators to provide all power requirements, a hydraulic motor that utilizes pressure drop in the rich-oil stream to drive a lean-oil pump, and instrumentation to the extent that only one operator and helper are required for efficient operation.

Hydrocracking Offers Flexible Gasoline-Distillate Output 102

UOP's new Lomax process uses fixed-bed catalyst, produces no catalyst deposit, and can use a wide variety of charge stocks.

The Foreman's Page 115

Here are review questions and answers on fluid flow.

Oil May Find Tough Sledding in Plastics 121

By Walter J. Talley, Jr.

Observing petroleum's move to plastics, some chemical veterans seriously question whether oil can ever rise above second rank in this fast-paced field. The answer seems to lie in divorcing the chemical-plastics division from petroleum operations and thinking.

Questions on Technology 125

American Tanker Rates schedule becoming more widely used.

Drilling-Production

Effect of Bit Weight on Drilling Rate 90

By Preston L. Moore and Carl Gatlin

Part 4 of a series on how to reduce drilling costs. Study is needed in this area even though some of our empirical approaches serve well. Here is a resume of work already done to establish how instantaneous drilling rate varies with bit weight.

Simplified Gas Flow Formula from Limited Equation of State 94

By W. L. Ducker

Suitable for routine algebraic solution, this formula is the result of integration of a compressibility correction factor along with the other variables in the basic differential equation. Simplification is possible because only temperatures and pressures common to line operating conditions are considered.

Check List Keeps Rig Safety on Its Toes 118

By Bob Smith

A maintenance check sheet which must carry every man's signature showing that he has inspected assigned equipment, plus an explanation of economics of safety make a two-part program for successful drilling rig safety.

Pipelining

Selection of Gas Turbines for the Compressor Station 107

By J. L. Mangan and T. C. Heard

Under the usual varying conditions of most main-line compressor stations, the load can more easily be handled by two-shaft turbines. Single-shaft turbines are used for peak-loading stations, and where line variations can be handled by more flexible adjoining compressor stations.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
May 23, 1960

What's squeezing the crude market?

There are a number of pressure points shown in an analysis by The Journal. Included are:

Climb of imports since World War II and the dive in exports.

Expanded natural gas and natural-gas liquids use.

Smaller annual gains in the total demand for petroleum.

Changing refinery yields which have resulted in the use of less crude to make a given volume of motor fuel (p. 61).*

The domestic crude market may be firming a bit.

One indication: Most major buyers at the Texas Railroad Commission hearing last week appeared fairly optimistic. A tight producing pattern of 8 days was retained for June. This means a slight increase in production over the current month (p. 75).

Another straw in the wind: Late last week no Kansas buyers had followed Derby Refining Co.'s 20-cent cut. Involved in Derby's reduction is 15,800 bbl. The Wichita company's top price is now $2.85 per barrel.

▼ ▼ ▼

The apparent meaning of announced refinery run cuts:

Somebody is kidding or some of the quiet ones are busy. API figures show runs jumped 246,000 bbl. daily during week ended May 13. The industry had expected a drop. Daily average of 8,034,000 bbl. was 350,0000 bbl. over runs in the same week a year ago.

Increases were in the coastal areas. Louisiana Gulf rose 114,000 bbl. daily; East Coast went up 101,000 bbl. daily; West Coast rose 57,000 bbl. daily. District 2 showed a drop. For the details see p. 173.

The global grapevine:

Has India been offered some cheap Russian crude?

The government is sounding out the country's three refining companies—Caltex, Stanvac and Burmah-Shell—about the possibility of processing Soviet crude. All three have their own sources of imported crude and there is little doubt as to what their reaction will be.

First location for Venezuela's national oil company.

Empresa Petrolera Venezolana is expected to drill its first well in the Ruiz-3 area of eastern Venezuela. The new company would be spudding in on a national reserve tract between two fields developed by Atlantic and Phillips.

A Caracas rumor is that private companies may do some drilling for the national company. Probably one or more of the "big three" companies in the country will bow to government pressure to drill. The reason: To avoid further jeopardizing the position of private capital.

Angels found to underwrite huge YPF drilling program.

The money-short Argentine government oil company is now studying a proposed refinancing program for $72 million worth of drilling contracts.

Reports are that Pan American International and two other firms will do the underwriting. The contracts call for the completing of 1,800 wells by 1964 in the Comodoro Rivadavia field (p. 84).

Exploration notes from West, North and way North:

Northwest Lisbon seems to be white hot.

Pure Oil Co. has a second well in San Juan County, Utah, that shows commercial production from the Devonian. Condensate was recovered at the rate of 27 bbl. per hour and gas gaged at the rate of 6,450 M.c.f. daily on drill-stem test at 1 USA-C, formerly 3 Northwest Lisbon.

Wyoming is the hot spot in the Rockies.

Rotaries working there amount to more than 25% of the active rigs in the Rocky Mountain area. Most activity is in Powder River's northeastern corner and central Sweetwater County in Green River basin (p. 149).

Protection string set in Yakataga, Alaska, well.

Richfield Oil has set 13,424 ft. of 7-in. casing in this wildcat. The purpose: If a second well to be drilled 2 miles to the north hits any pay, company can easily go back into number one and test the same zone.

Look for a new antiknock lab testing procedure soon.

Increased talk of the gas turbine for automotive use is not slowing refiners' efforts to develop a better lab test for measuring gasoline antiknock quality above 100 octane.

A fresh interest in new hydrocracking processes.

Mid-Continent refiners are rechecking the new methods of hydrocracking middle and heavy distillates to gasoline—Isocracking, Lomax, and Unicracking.

The reasons: A deteriorating outlook for returns on heat-

ing oil because of natural gas competition. An expectation of lower cost hydrogen. The most optimistic believe these new processes might catch on like cat reforming.

Can oil companies make the grade in the plastics field? Large oil companies move with deliberation. To keep up with the fast-paced plastics industry, petrochemical operations of petroleum firms should have more authority for independent action says a management consultant (p. 121).

Serious overcapacity for maleic anhydride looms. If plans of California Standard, Allied Chemical, American Cyanamid, and others aren't changed, capacity for the chemical will exceed 200 million pounds yearly by 1961. Present capacity is about 80 million pounds, but 1959 production was 65 million pounds with yearly growth estimated at 15%. The intermediate chemical, used in making polyester resins for the reinforced plastics market, has been in short supply.

▼ ▼ ▼

Gas industry projects mark time as FPC inquiry drags on. Commission members who have been busy answering questions of a House subcommittee have about $1 billion in gas-line construction projects awaiting their approval. Many of the projects must be cleared by July 1 if installation is to be completed this year.

Going up: U. S. stripper wells and their output. The latest survey shows stripper production was up 7.8% in 1958 and there were 1,351 more wells in this category than in the previous year. Included in the stripper class are 65% of all U. S. wells (p. 69).

A different look at petroleum demand in the 60's. Demand in the U. S. will grow at a slower percentage rate in this decade than in the last, but it will come close to the same volume rate of increase it hit in the 50's.

Shell's A. A. Buzzi figures: The future rate of increase will be slightly more than 3% against an annual average of 5% for the past 10 years. This means an increase of 3.5 million barrels per day by 1969, a gain of 37%. In the preceding decade the growth in volume was 3.6 million barrels.

Jersey Standard has grabbed off the lucrative Baja California market from Mobil Oil Co. Pemex has signed an exclusive contract with Esso Export for about 7,000 bbl. of products daily. Products will go from Aruba to bonded storage in Los Angeles, thence by Pemex truck to market.

Market Memo

May 23, 1960

The oil industry can't have a summit conference to discuss low product prices, but why can't executives control their own runs in an oversupplied market?

Crude runs held to seasonal demands would be the greatest boon to better product prices since indoor plumbing for service stations.

Incremental barrels of crude processed become incremental gallons of products to be sold at distress prices. They undermine posted product prices, as well as crude prices.

The Midwest is the sore market spot, where crude runs are 5% higher than the industry average and there's 6,000,000 bbl. more gasoline than a year ago. Most is unsold, incremental gallonage.

Chicago markets are as active as Midway airport. It's the most confused price market in the Midwest.

Gulf Coast is a brighter spot. Crude runs are down and product stocks, except gasoline, are under last year. East Coast majors are quietly lifting cargo gasoline, No. 2 and No. 6. There's been enough No. 2 buying that it's tight at anything off the Gulf Coast low. Buyers are looking for No. 2 at a quarter off and not finding any.

Mississippi River markets are in the middle, between a weak Group 3 and a slowly improving Gulf Coast market.

Here's the industry's price lineup:

Group 3 gasoline posting remains at 10.5 cents to the trade for 91 RON with discounts of .25 to volume buyers. No. 1 and No. 2 prices just aren't fit topics of conversation today among respectable Oklahoma refiners.

Chicago gasoline markets, though confused, appear a shade firmer at 0.25 cent off the 11-cent posted price for 91 RON. No. 1 and No. 2 in Chicago are 0.125 to 0.25 cent off posted price of 9.25 and 8.5 cents respectively. And a seller is lucky if an order comes in.

At midriver points, gasoline is being offered to "likely" upriver buyers at 0.375 cent off Gulf Coast low, with no deals being closed. Spot gasoline ranges from Gulf Coast low to 0.5 cent off. Middle distillate offerings off the river are not attracting buyer interest at this time. No. 2 is readily available from midriver points at 0.25 cent or more off Gulf Coast low postings.

Gulf Coast gasoline at 0.5 to 0.75 cent off published cargo prices is not helping refiners improve profit and loss reports.

For spot prices see page 174.

From TOP to BOTTOM

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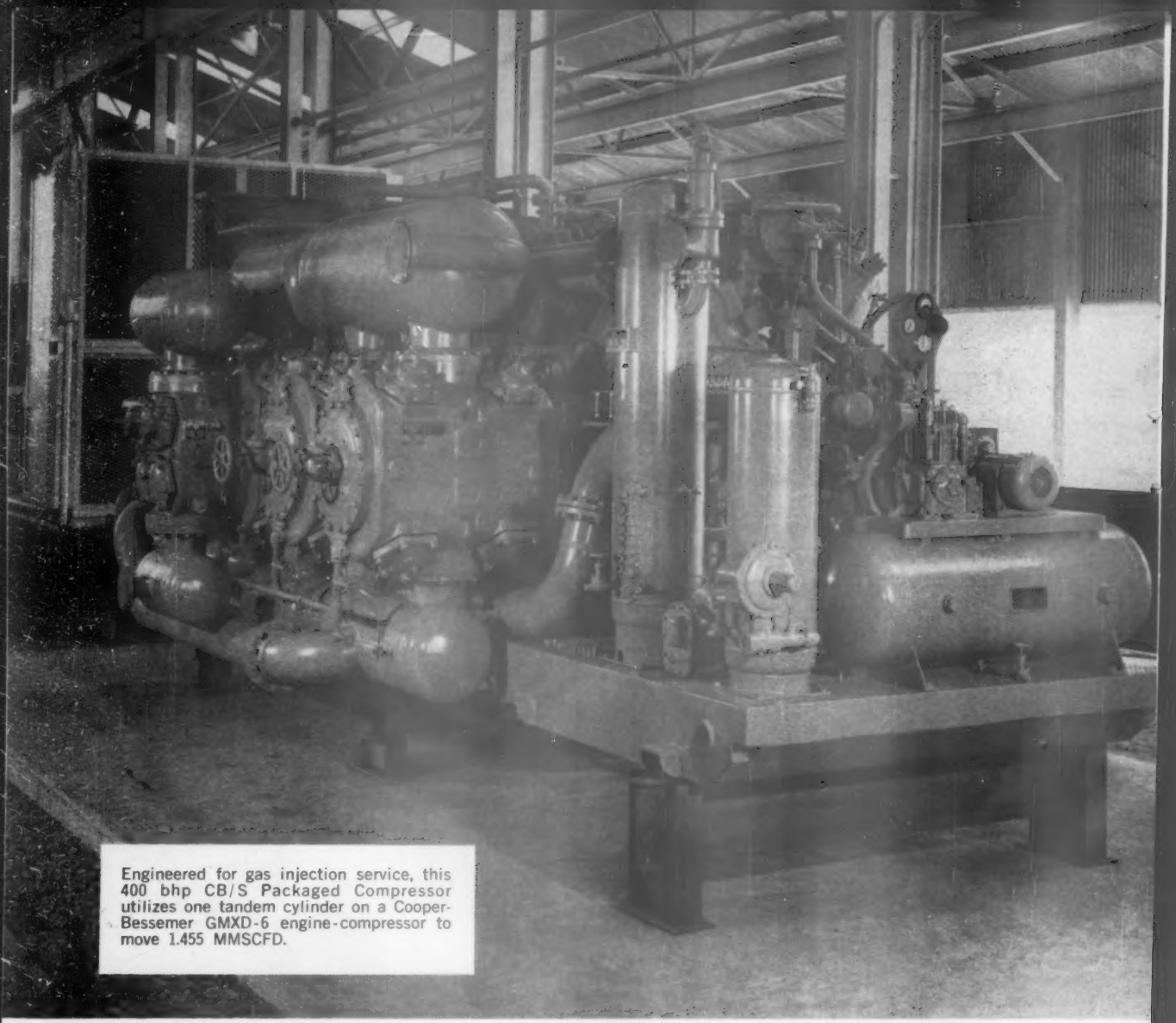
TULSA, OKLAHOMA

39 YEARS OF PROGRESS WITH THE OIL INDUSTRY



Engineered for gas injection service, this 400 bhp CB/S Packaged Compressor utilizes one tandem cylinder on a Cooper-Bessemer GMXD-6 engine-compressor to move 1.455 MMSCFD.

Building packaged compressors is our business . . . our only business. This single objective is the reason CB/S Packaged Compressors are more advanced in design . . . more efficient in the field.

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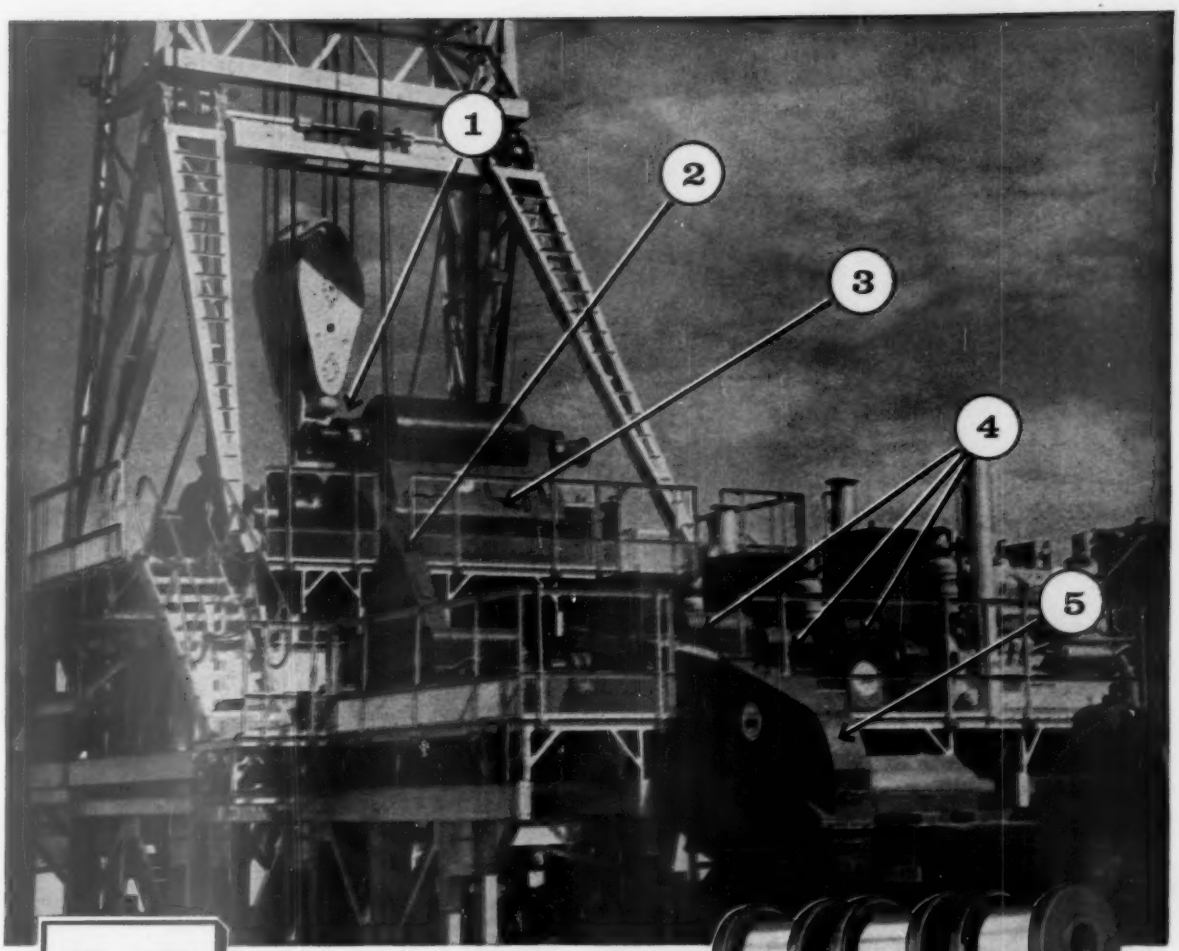
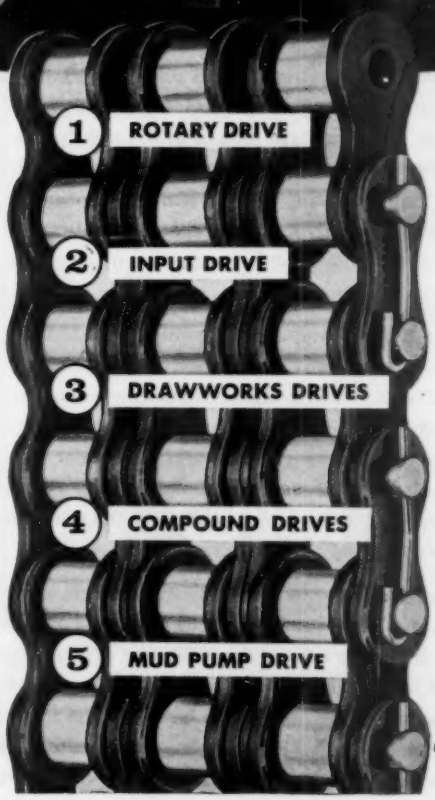


Throughout

today's foremost rigs you see LINK-BELT FR® roller chain

THIS National Supply Company rig relies heavily on Link-Belt FR (Fatigue Resistant) roller chain . . . as do countless other industry leaders. The reason? *No other roller chain has greater capacity to withstand the smashing impacts and tortuous stresses met in day-to-day drilling.* This tremendous endurance is a result of Link-Belt's patented FR process . . . a unique method of strengthening critical sidebar areas most vulnerable to fatigue failure.

FR is standard with all Link-Belt oil field roller chains. So are these other Link-Belt *dynamic strength extras:* close heat-treat control, pre-stressing, pitch-hole preparation, shot-peened rollers. Complete details are contained in Catalog 2980 . . . available at any leading supply store.



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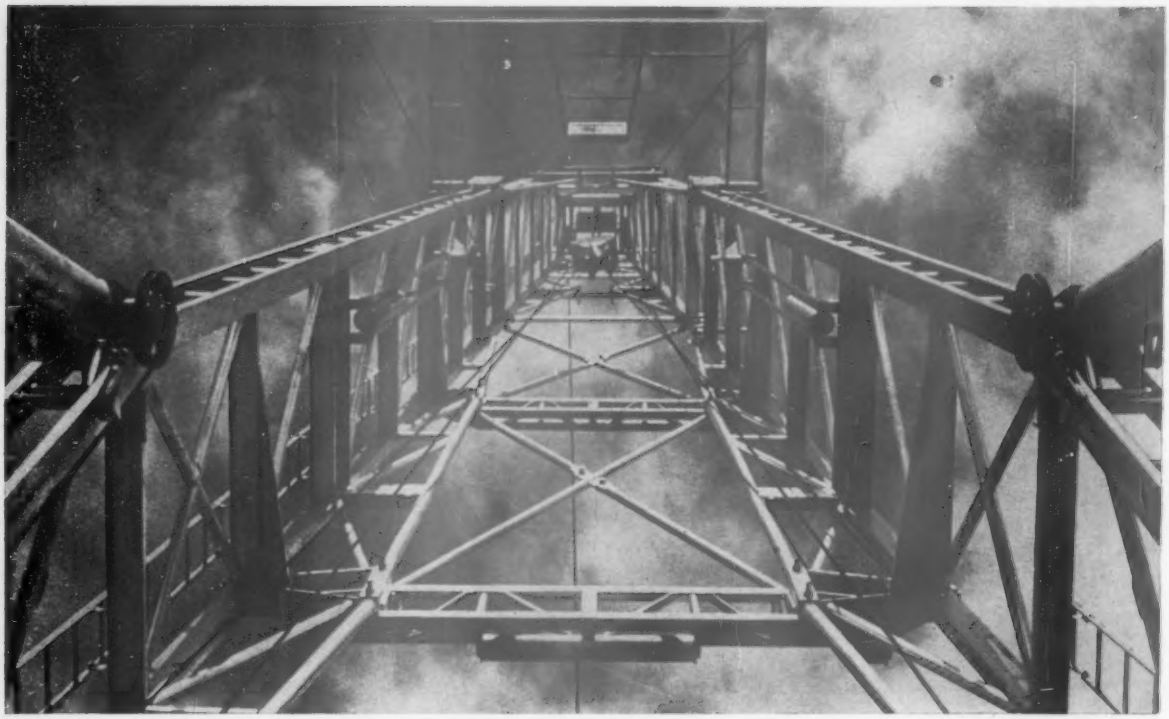

"Oilwell" Lever-Lift Masts are designed to withstand winds to 100 mph*

You get rigid strength and stability in Lever-Lift Masts because they are of jig-fabricated, welded-steel construction, with the right shapes in the right places. They are able to withstand 100 mph winds with a full pipe load. In addition, they are carefully engineered with many timesaving advantages and safety features which result in faster moves and rig-up, plus more efficient drilling.

Timesaving advantages: The mast is assembled on the ground where permanently attached leg locks and T-fasteners can be connected quickly. Draw works power pulls the mast to the substructure where each leg is attached with U-clamp and one bolt. Patented raising levers raise the mast smoothly and safely. No accessory equipment is needed. Eccentric leveling mechanism quickly centers crown block over the well. The mast can be moved as a single unit or as five sections.

Safety features: An automatic latch with over-travel stop makes it impossible to pull mast over during erection. While raising the mast, the driller is safe because all moving mechanism is in front of him. Because of this, too, any draw works can be used. The four-line raising system provides a low raising load and maximum safety. In operation, the driller has a clear view of the mast top to permit rapid block travel. The patented crown block design puts both fast and dead lines outside and behind the mast, preventing interference with the traveling block and eliminating twisting loads on the crown block. The traveling block has its flat side and deadline towards the derrickman. Lever-Lift Masts meet A.P.I. specifications for hook load and substructure capacity.

Your "Oilwell" or Wilson Supply Company representative can give you more specific details about "Oilwell's" Lever-Lift Mast.

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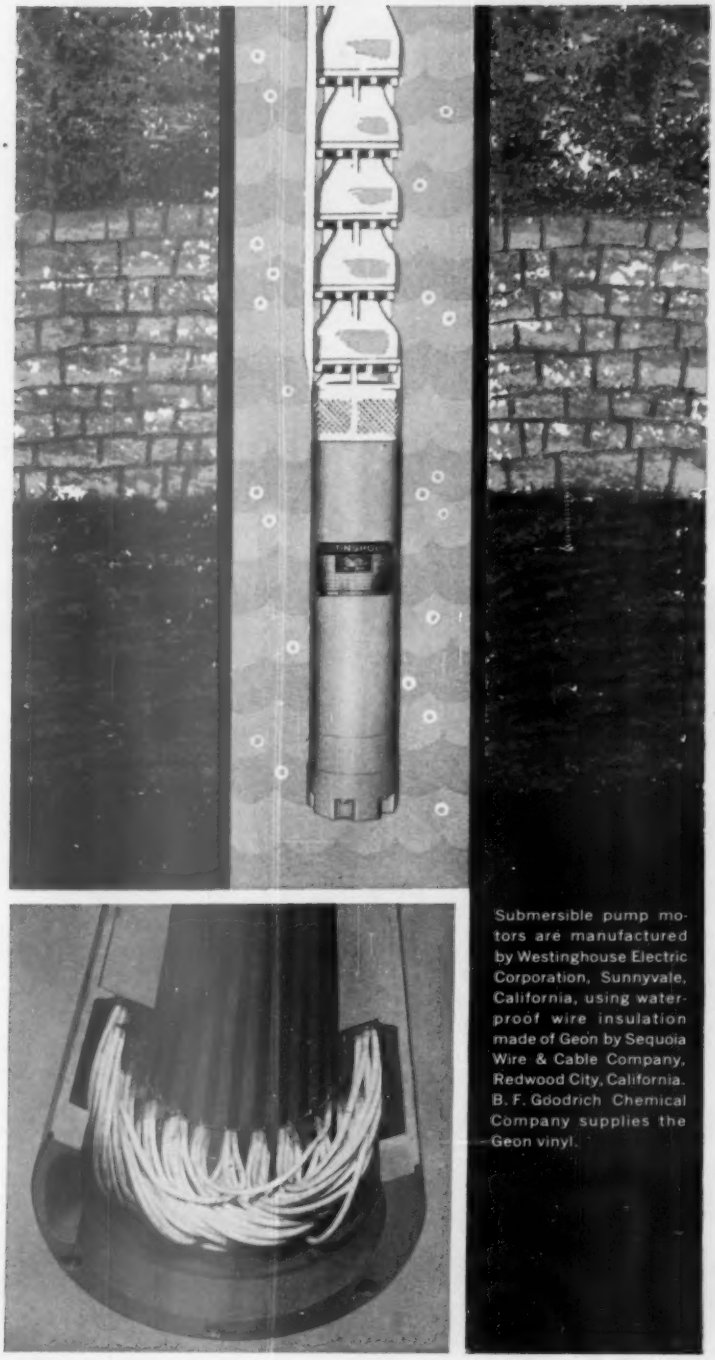
USS Oil Well Supply Division of United States Steel

Executive Office: Dallas, Texas
Export Office: 30 Rockefeller Plaza, New York 20, N. Y.

*Calculated in accordance with API Standard 4D

Another new development using

B.F.Goodrich Chemical *raw materials*



Submersible pump motors are manufactured by Westinghouse Electric Corporation, Sunnyvale, California, using waterproof wire insulation made of Geon by Sequoia Wire & Cable Company, Redwood City, California. B. F. Goodrich Chemical Company supplies the Geon vinyl.

Problem of motor submersion solved with Geon insulation

This new motor operates under water using the water itself as a lubricant. Since the housing is water filled and "breathes" well water, its operation depends on the insulation of Geon.

Geon met tough requirements. The manufacturer says that many materials were tested to find one that would stay waterproof indefinitely and also have enough mechanical strength to stand up under the winding process and under flexing imposed in starting.

A test motor was submerged under 400 feet of head for six months and subjected to frequent starting and operation. At the end of the test, the Geon insulation showed no signs of deterioration. Geon also eliminates need for thick and dense coatings over end turns—eliminating a cause of trapped heat and premature failure.

Here's another example of the way that Geon vinyls open new markets, or improve present applications. For more information, write Dept. GR-3, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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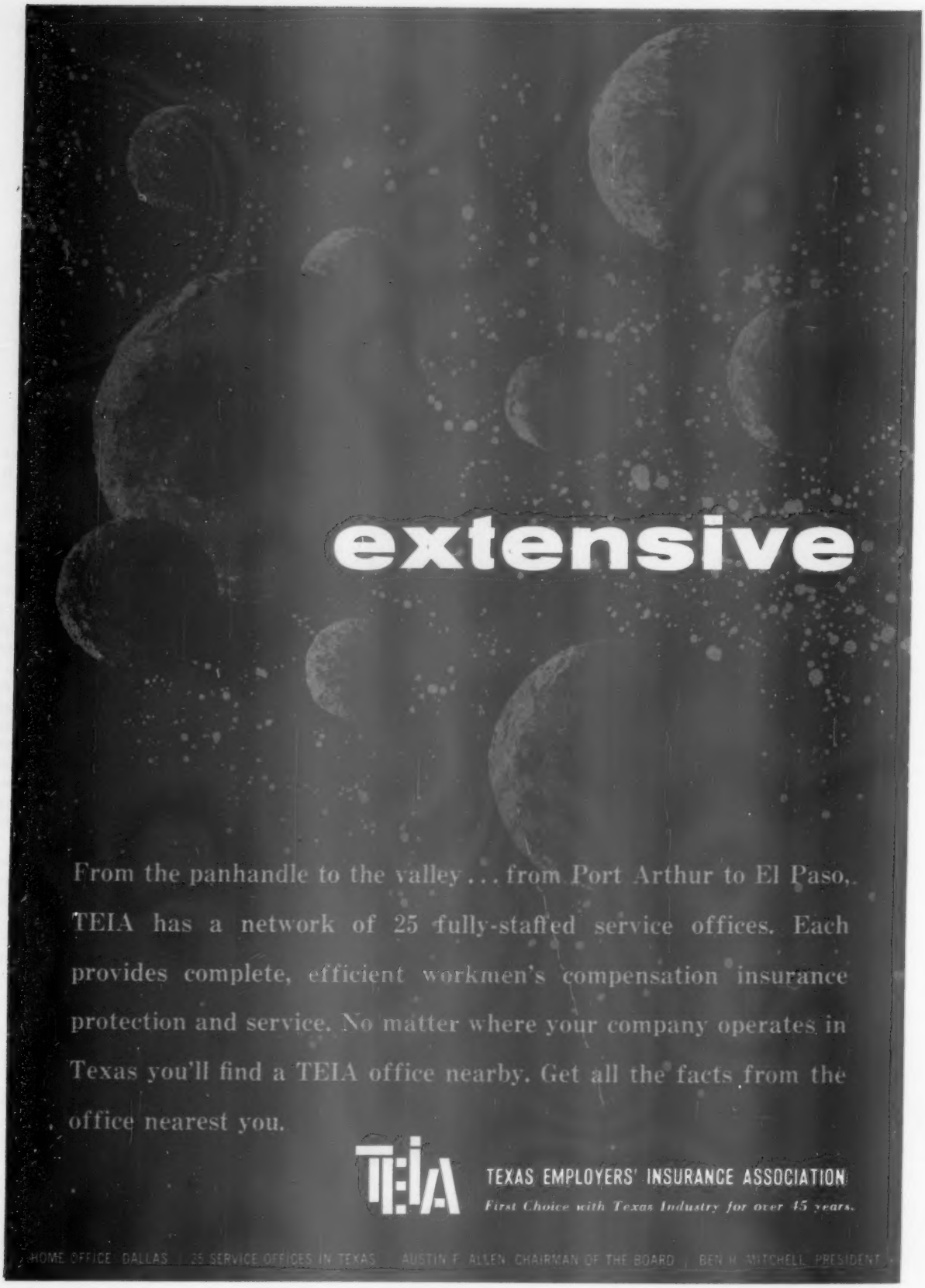
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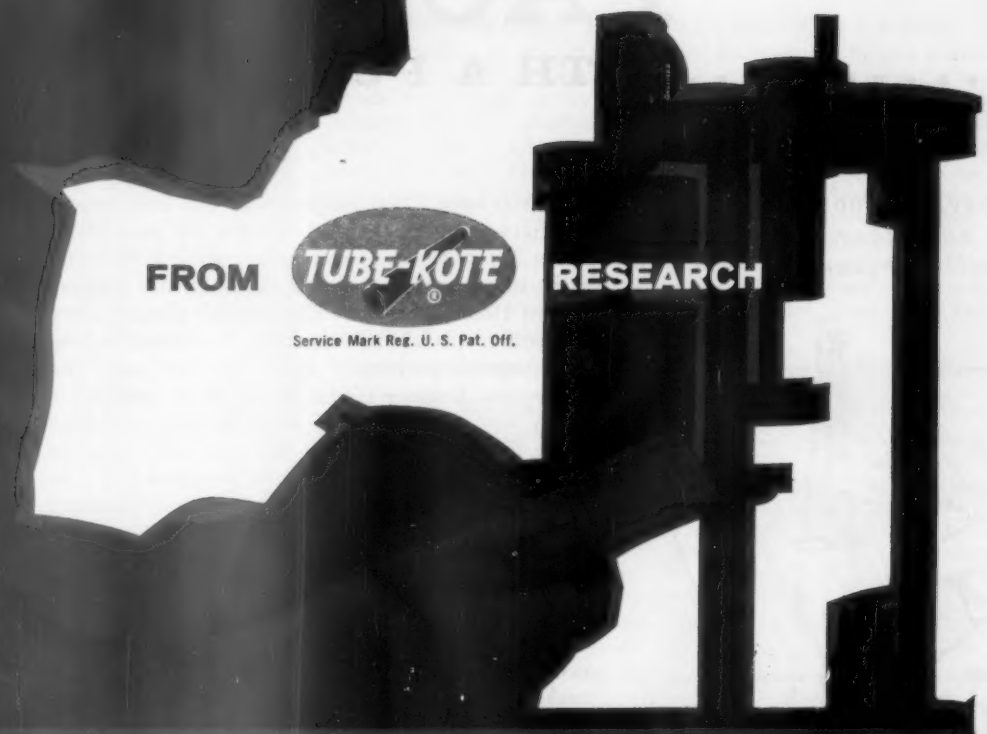

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PACKERS

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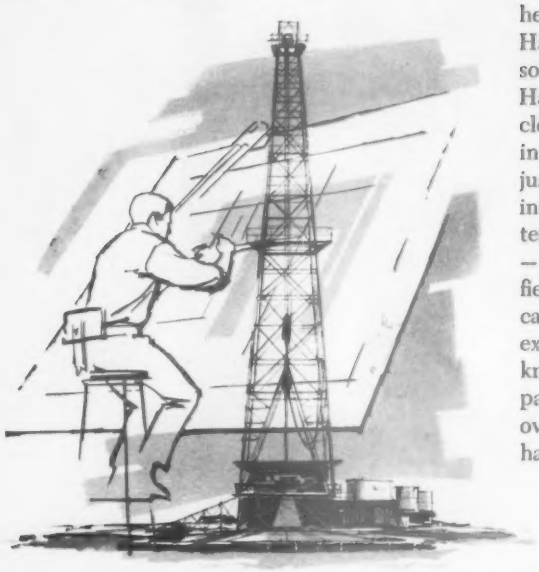
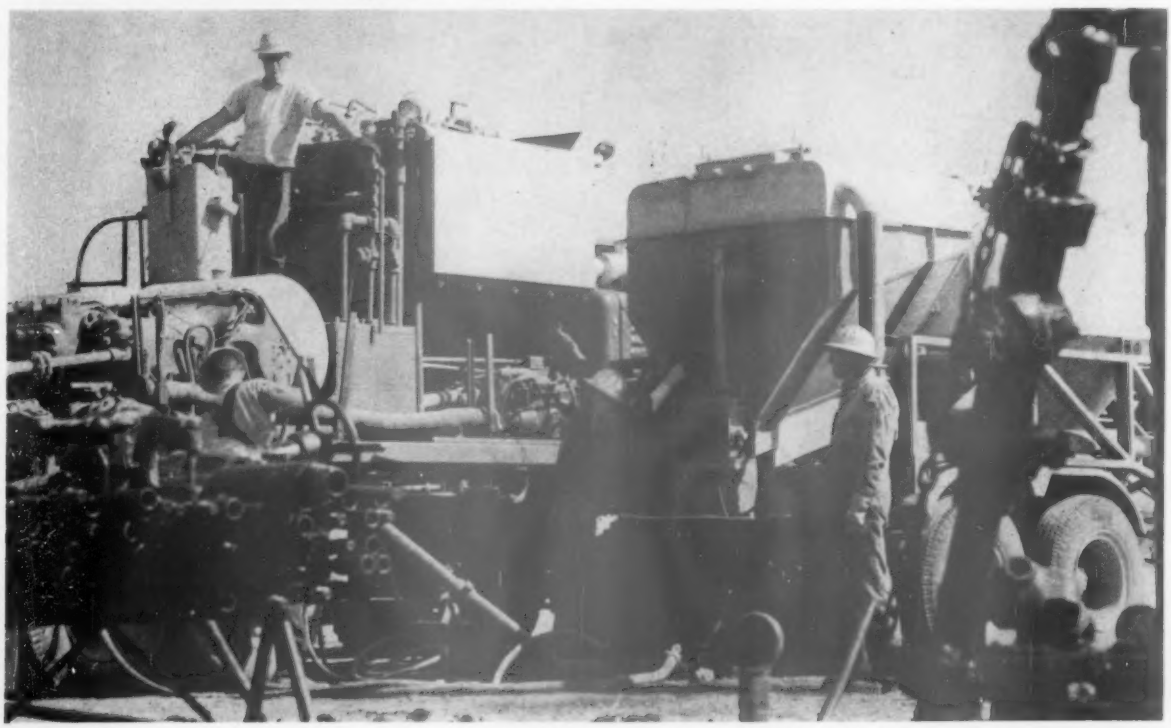
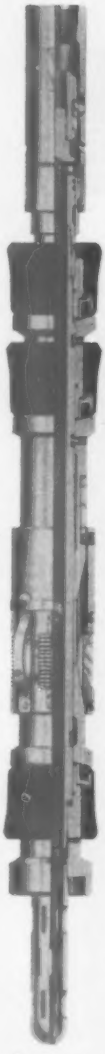
Halliburton Special Tools are experience engineered for specific well services



When you have a real problem – in well completions – in fracturing – in treating, chances are your Halliburton Representative can help you solve it with one of the many special tools that make up the comprehensive Halliburton line. The reason? Almost every Halliburton special tool was originally created to help solve a specific problem . . . maybe just like yours. The Halliburton Engineers who design these tools work closely with people directly involved with operations in the field so they can get first hand knowledge of just what is needed. Bringing the design to life is an interesting story . . . exact manufacturing . . . exhaustive testing . . . modification . . . new ideas . . . more testing – until finally the finished product is released to the field and run in wells – maybe yours – helping take care of a job that *used* to be a problem. Some typical examples of the advanced thinking and unsurpassed know-how of Halliburton Engineers are shown by the packers you will read about on these pages. Look them over and see where these tools can help you as they have helped operators all over the world.



Retrievable Test-Treat-Squeeze Packer



Cup-Type Retrievable Bridge Plug

RTTS (RETRIEVABLE TEST-TREAT-SQUEEZE) PACKER

A multipurpose hook wall type Packer designed with special features to perform a single or multistage testing, treating or squeezing job on a single trip. Set by turning the tubing to allow the mechanical slips to engage the casing wall so the tubing weight may be set down to expand the packer rubbers. Hydraulic slips above the packer rubber and mechanical slips below act to help prevent packer movement from pressure applied either above or below the expanded packer rubbers. A unique safety joint allows the tubing to be rotated out of the hole, or disconnected from the RTTS Packer. Full opening mandrel permits passage of large fluid volumes with minimum pressure drop and is adequate for passage of tubing type perforating guns. This multipurpose packer can be moved to any position in the hole, where other zones can be tested, treated, or squeezed. Readily available in a full range of sizes.

CUP TYPE RETRIEVABLE BRIDGE PLUG

This tool, an excellent companion to the RTTS Packer, is designed to be run alone on tubing and with compatible setting characteristics so they may be run in a cased hole together. Once in the hole, tubing manipulation sets the dual wedge slips of the Bridge Plug and with application of pressure differential, the cup-type sealing elements are self-sealing. This allows the tool to resist movement from pressure above or below. By applying upward pull on the tubing after the Cup Type Bridge Plug is set, the RTTS Packer with the overshot still attached can be pulled up and set higher in the well to straddle the zone to be tested, treated or squeezed. The Cup Type Bridge Plug is also suitable for formation fracturing operations.

HM (HYDRAULIC-MECHANICAL) RETRIEVABLE PACKER

Another multipurpose full-opening hook wall type packer designed to be run in casing on tubing to isolate a zone to be tested, acidized or *fractured*. After setting, movement in either direction is minimized by hydraulic slips engaging the casing above the packer, and mechanical slips engaging the casing below the packer. Since merely picking up the tubing unseats the packer and returns it to a locked open position, the tool may be set as many times as desired on a single trip in the hole.

R-3 RETRIEVABLE TREATING PACKER

A trim, compact retrievable packer designed to be run on tubing into a cased hole to isolate a zone to be treated or *produced*. Unique design permits running packer in one of two ways . . . with the packer rubber down so that it may be set by rotation and an upward pull on tubing . . . or inverted for running as an upside-down hook wall packer. The tool is drillable, economical, and versatile when used for treating, fracturing, water flooding or producing wells.

"HM" Packer

R-3 Treating Packer

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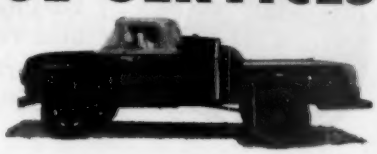
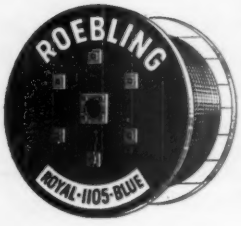


"The Right Tool—The Right Way—On Every Job"

IF THE WIRE ROPE YOU'RE USING HASN'T GOT IT HERE...IT HASN'T GOT IT



This rope has it—and has it at every critical point of wear for these reasons:
Extra Resistance to Bending Fatigue · Extra High Strength
Good Flexibility and Excellent Resistance to · Shock · Abrasion · Impact · Crushing
For anything you want to know about Roebling Royal Blue Wire Rope, ask your Distributor or Roebling's Wire Rope Division, Trenton 2, N. J.

ROEBLING

Branch Offices in Principal Cities *John A. Roebling's Sons Division · The Colorado Fuel and Iron Corporation*

JONES

FIRST IN 1894...

Samuel M. Jones, pioneer oil operator, received the first patent on an all-metal sucker rod joint in 1894 . . . the result of searching for a better method of pumping oil than with troublesome wooden rods. This was the beginning of JONES specialization . . .

FIRST TODAY...

Today, nearly one-half billion feet of Jones Sucker Rods have been manufactured . . . many of the original rods are still giving good service in Eastern and Mid-Continent fields. JONES has always maintained leadership by concentrating **wholly** on making the finest sucker rods available!

...because we're Sucker Rod Specialists!

There are four JONES JOB-ENGINEERED SUCKER RODS... a type for every pumping need!

THE S. M. JONES COMPANY

Division of Buffalo Eclipse Corporation

General Office and Factory: TOLEDO, OHIO

Sales Office: Enterprise Building, TULSA, OKLAHOMA

Export Sales Representatives:

IDECO, One of the Dresser Industries, Dallas—New York

Franklin Supply Company, Export Division, Inc., New York

engine power
BY CATERPILLAR

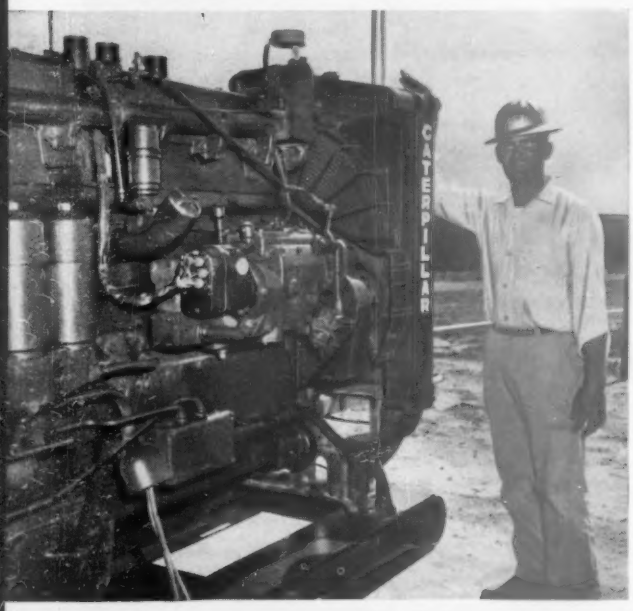
Cat G342... lowest operating costs, highest output for its size of any natural gas engine on the market

The Cat G342 Natural Gas Engine is the *lowest cost* gas engine available both in initial cost and over-all operating cost. It produces 280 *continuous* horsepower @ 1200 RPM.

Because the six-cylinder G342 is built on a basic diesel engine block, it operates continuously at full HP *without derating*. Only pistons and fuel systems have been changed for operation on natural gas.

Available in compression ratios of 10.5:1 or 7.5:1, depending upon type of fuel to be used, the G342 is built with the dependability and economy that have made Cat Engines famous. With the 10.5:1 ratio these engines use only *7000 BTU per brake horsepower-hour!*

This Caterpillar G342 Natural Gas Engine powers a Chicago Pneumatic gas compressor near Beeville, Texas, for Northern Pump Company of Minneapolis, Minn. Lease Pumper Marvin Rabe stands beside the G342 which pumps one to two million cubic feet per 24 hrs. of excess gas into oil producing sand to maintain pressure. This prolongs the flowing life of the four producing wells served and increases ultimate recovery of oil from the field.



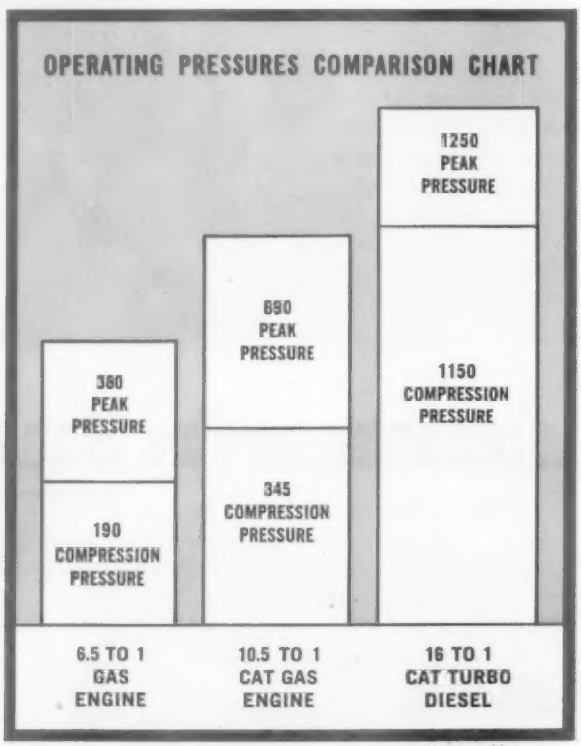
Specify Cat power when ordering your oilfield equipment. Caterpillar Natural Gas Engines are available in 6, 8, or 12 cylinders, naturally aspirated or turbocharged and aftercooled, up to 560 HP. Call your Caterpillar Dealer for the facts.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

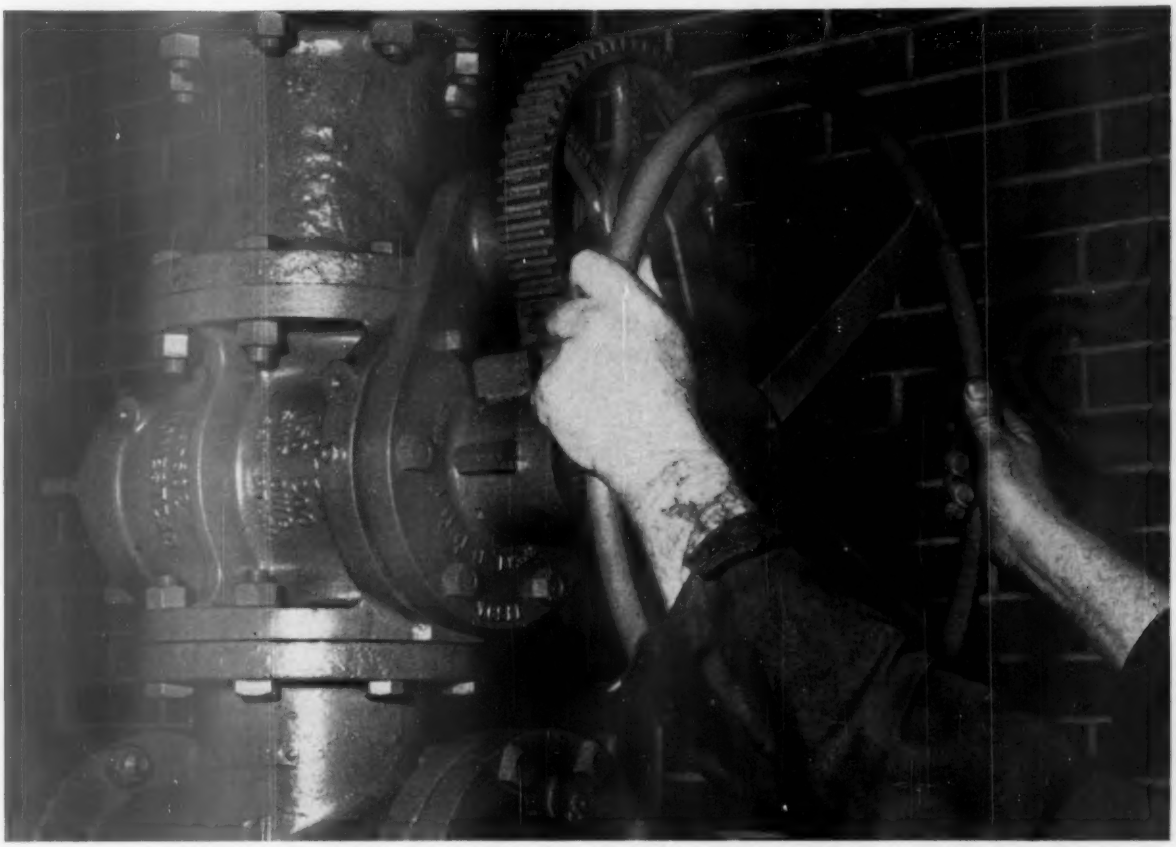
Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

Caterpillar Turbocharged Diesel operating pressures are in the neighborhood of 3½ times that of 6.5:1 compression ratio gas engines. Cat Gas Engines are basically diesel design. They operate at little over half the pressures their diesel components are designed to withstand. Therefore, Cat Gas Engines *need not be derated*. Other make engines, designed explicitly for gas service and of correspondingly lighter construction, find it necessary to derate under continuous operation to provide reasonable engine life.



100% FLUID CONTROL AT YOUR FINGERTIPS

with Homestead Lubricated Plug Valves. When open, they provide full pipe-sized passage to fluids. Closed, their controlled high pressure lubricant



system, plus extremely close plug and body tolerance, guarantee a complete chemical seal—positive shut-off without contamination of line fluids. Instant response is sure, too, because piston-like movement of plug during each lubrication prevents sticking. They are low in first cost—low in upkeep. Write for complete details.

hv

HOMESTEAD VALVE MANUFACTURING COMPANY
P.O. Box 406, Coraopolis, Pennsylvania

406

Gentlemen: Please send me Catalog 39-1 and prices on Homestead Lubricated Plug Valves

Name..... Title.....

Company.....

Address.....

City..... Zone.... State.....

Engineering Progress Report

FROM UNION CARBIDE CHEMICALS COMPANY

Acetonitrile boosts butylene throughput 58%, saves $3,000,000 capital investment

Unusual solvent useful in saturate-unsaturate and olefin-diolefin separations

By using acetonitrile as an extractive distillation solvent, Shell Chemical Corporation has boosted throughput of the existing butadiene feed-preparation unit 58% in their Torrance plant. Minor engineering changes for the unit cost $148,000: it has been estimated that a similar throughput increase through new construction would cost about $3,000,000. Development work and operating experience have shown that acetonitrile's unusual solvent properties should prove useful in other saturate-unsaturate and olefin-diolefin separation processes.

ADVANTAGES OF ACETONITRILE

Acetonitrile has boosted capacity in the Shell plant because it increases the spread in boiling points of the C_4 hydrocarbons being distilled. Thus, separation of the hydrocarbons is more efficient than with either acetone or furfural. Relative volatility of n-butane compared to butene-1 is about 1.25 with acetone and about 1.30 with furfural. Acetonitrile increases this ratio to almost 1.4. The spread in boiling points of butene-1 and butadiene is also increased. The table gives data on the relative volatilities of C_4 hydrocarbons in aqueous acetonitrile systems.

After the extractive distillation has been completed, acetonitrile can be completely recovered from the butane and butylene streams with greater ease than acetone. This increased recovery efficiency is due to the high distribution coefficient of acetonitrile in water/hydrocarbon systems.

ENGINEERING CHANGES MINOR

Because of the similarity of the physical properties of acetonitrile and acetone, it is not necessary to change the operating pressure of extractive distillation columns. Shell engineers made only minor changes to their unit. Besides a larger reboiler and a new pump, two heat exchangers were switched and the solvent recovery column was connected to vacuum operation. Aqueous acetonitrile systems do not foul exchanger systems. Corrosion due to hydrolysis of solvent at reboiler temperatures is minimized by pH control.

TABLE 1 RELATIVE VOLATILITIES OF THE C_4 HYDROCARBONS IN AQUEOUS ACETONITRILE, 120 psia

Component	Total Solvent Concentration, 80%m		Total Solvent Concentration, 85%m	
	Water in Solvent 15%m	Water in Solvent 25%m	Water in Solvent 15%m	Water in Solvent 25%m
Isobutane	1.638	1.673	1.637	1.674
n-Butane	1.332	1.347	1.348	1.368
Isobutylene	1.013	1.013	1.013	1.013
Butene-1	**1.000**	**1.000**	**1.000**	**1.000**
t-Butene-2	0.861	0.856	0.865	0.861
cis-Butene-2	0.821	0.813	0.827	0.820
Butadiene-1, 3	0.639	0.599	0.645	0.604
Water	0.08	0.045	0.075	0.045
Acetonitrile	0.043	0.033	0.043	0.033

OPERATING COST REDUCTIONS

The butadiene feed-preparation unit operating on acetonitrile has less solvent-loss than one operating on acetone. *Thus, solvent make-up costs are no higher with acetonitrile than with acetone.* Steam and pumping costs have also been reduced because reflux and circulation rates are lower. This is true even at reduced feed rates.

ACETONITRILE USEFUL IN OTHER PROCESSES

Acetonitrile is effective in other saturate-unsaturate and olefin-diolefin separations. This heat-stable extractant is useful in ethylene-ethane, propylene-propane, and cyclopentadiene-cyclopentane separations. The boiling point spreads between pentadienes, such as isoprene, and pentenes are also increased.

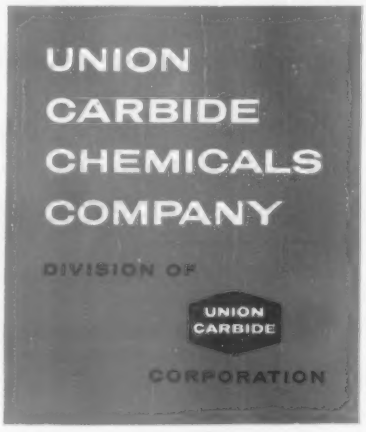
In liquid-liquid extraction processes, acetonitrile is effective in removing tars, phenols, and color bodies from hydrocarbons. Acetonitrile is also useful as a selective solvent for fatty acids.

INFORMATION AVAILABLE

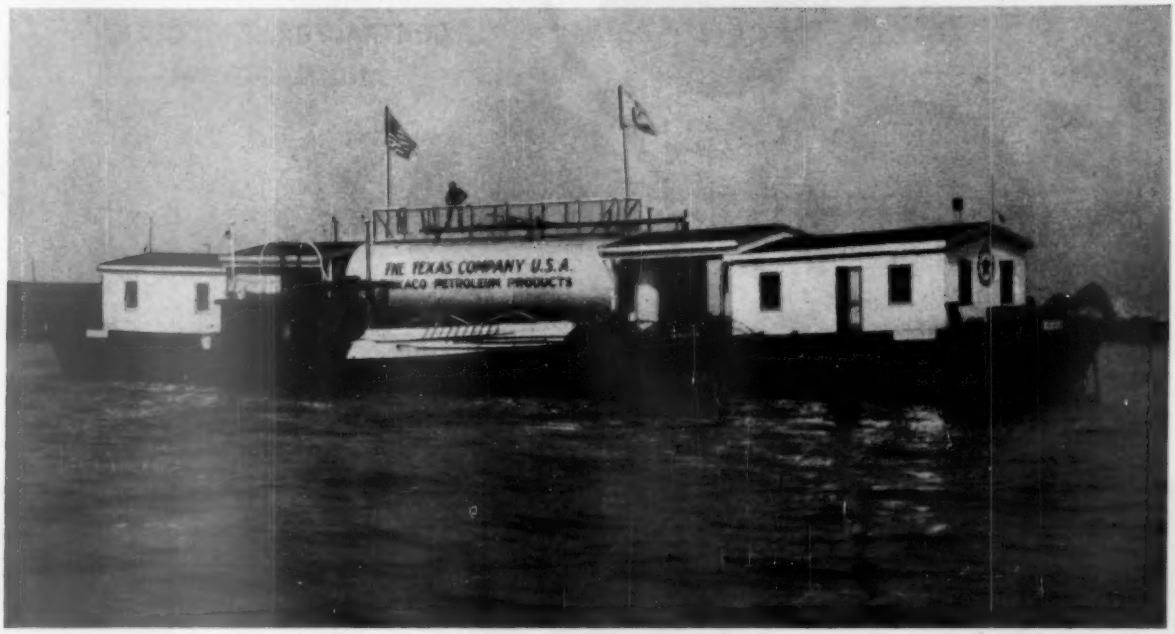
If you're looking for increased efficiency in your extractive distillation or liquid-liquid extraction processes, acetonitrile could be the answer. Detailed information on acetonitrile as an extractive distillation solvent along with information on azeotropic mixtures of acetonitrile is available. For this information, call the nearest CARBIDE Technical Representative—or write, Department B, Union Carbide Chemicals Company, 30 East 42nd Street, New York 17, New York.

Nothing herein shall constitute a recommendation to practice any invention covered by any patent without permission of the patent owner.

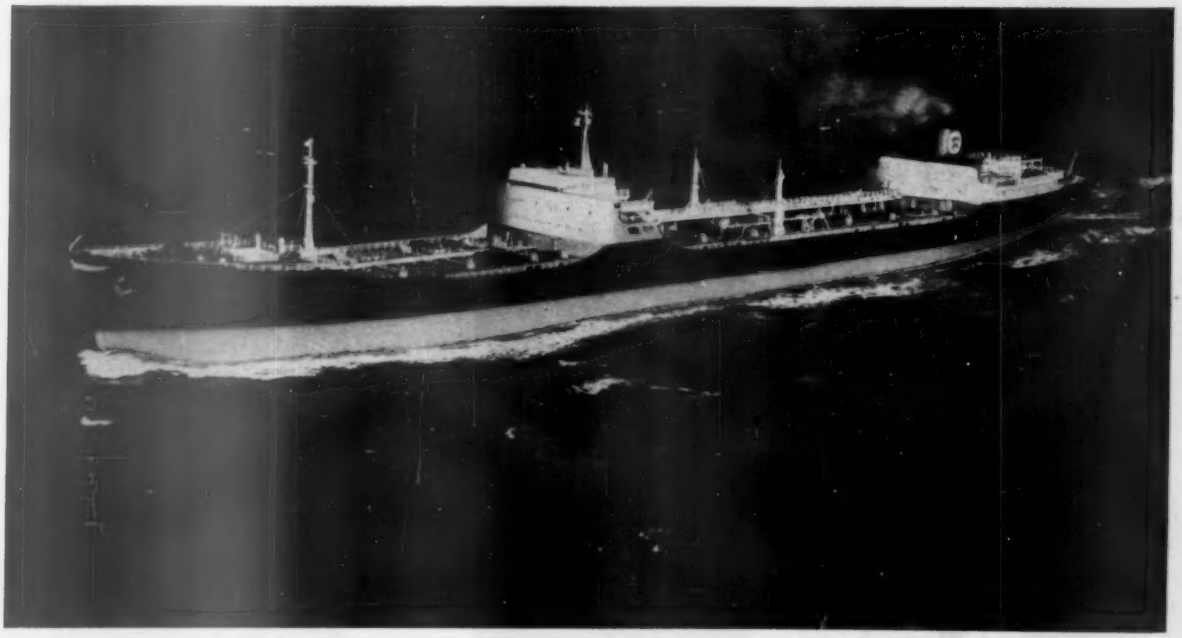
"Union Carbide" is a registered trade-mark of Union Carbide Corporation.



From coastal to global operations

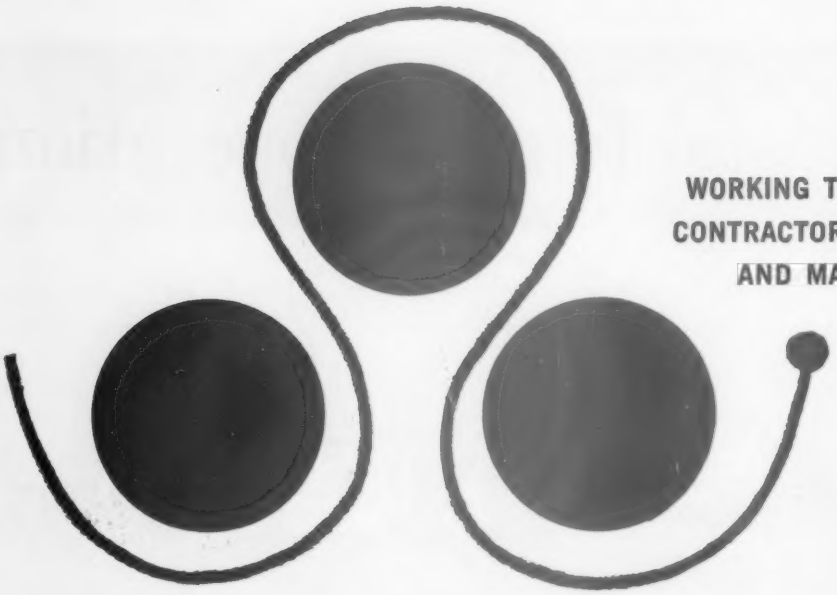


YESTERDAY—Shortly after its founding in 1902, Texaco had only one, small, wooden barge—transporting crude oil slowly along the Gulf Coast and up the Mississippi. Its capacity was 170,000 gallons.



TODAY—Texaco's giant steel tankers, like the Trinidad, ply the sea lanes of the free world, carrying up to 13-million gallons. This fleet forms part of a vast transportation network that helps keep the economy of the free world in balance. Continued Texaco growth, national and global, makes this possible.

TEXACO



WORKING TOGETHER...
CONTRACTOR, PRODUCER,
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plan mud programs for pay and profit

High drilling costs can be cut by efficient use of drilling fluids. The right drilling chemicals, **used right** by Magcobar engineers, can help increase penetration rates, save on trips and bits, reduce materials needed, and save on equipment and manpower.

But, to make sure that the mud program is the most efficient, it must be planned from the beginning. And, because it must deal with

nology. This Technology formulates special drilling fluids to reduce or prevent damage to the pay, resulting in quicker completion, higher production, and less need for expensive stimulation work. Magcobar Technology can help you as a contractor to drill wells more cheaply, can help you as a producer to have better wells. Drill your next wells with Planned Mud Programs with Magcobar.

Magcobar
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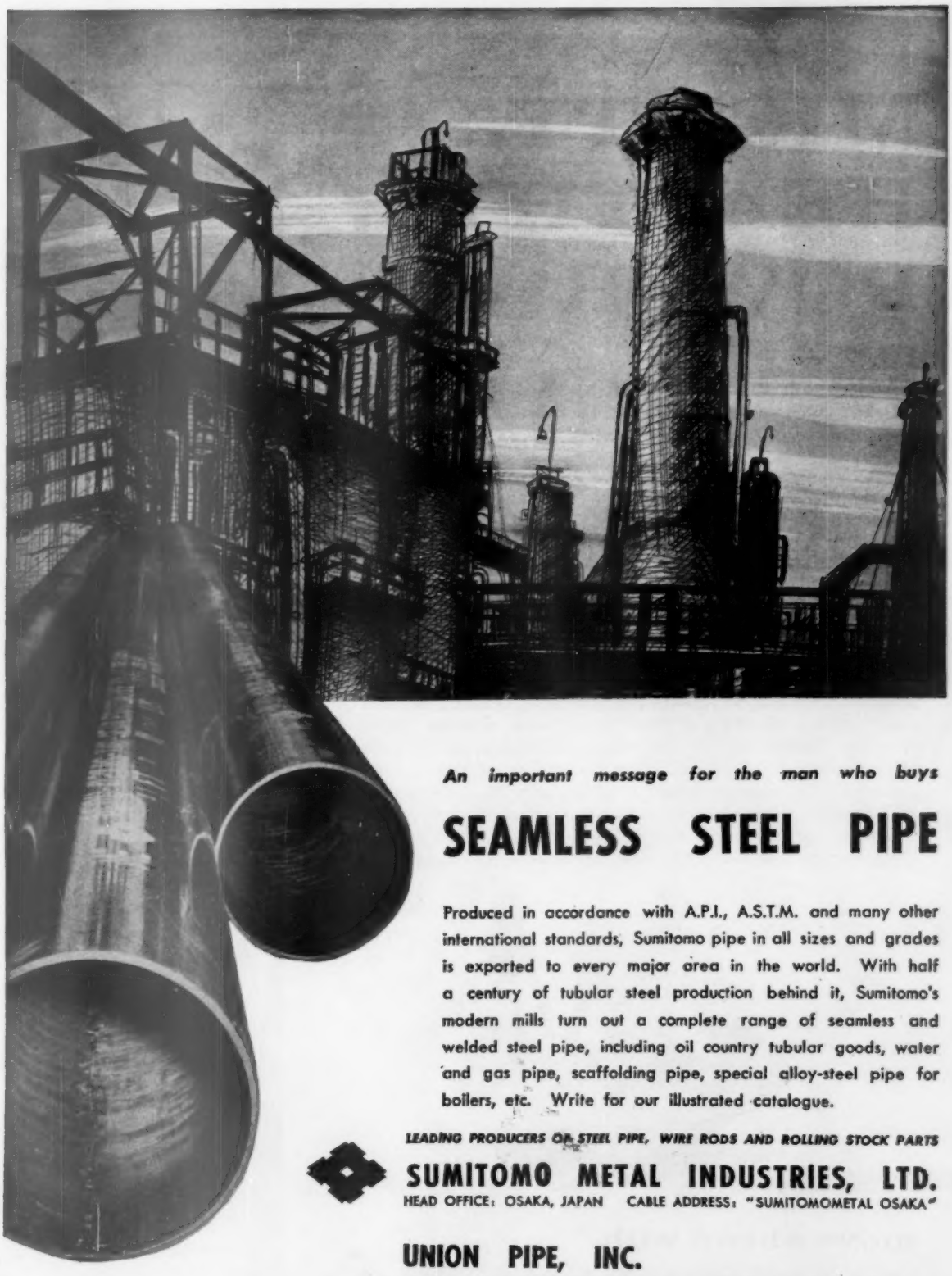

An important message for the man who buys

SEAMLESS STEEL PIPE

Produced in accordance with A.P.I., A.S.T.M. and many other international standards, Sumitomo pipe in all sizes and grades is exported to every major area in the world. With half a century of tubular steel production behind it, Sumitomo's modern mills turn out a complete range of seamless and welded steel pipe, including oil country tubular goods, water and gas pipe, scaffolding pipe, special alloy-steel pipe for boilers, etc. Write for our illustrated catalogue.

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MIGHTY... HEALTHY... POWER

Whether your choice is the 225-hp HD-21 or the 150-hp HD-16, you get from 8½% to 27% more efficient engine operation than from other crawlers.

This fuel-pinching efficiency is a fact! Your Allis-Chalmers dealer will show you actual proof of up to 27% fuel savings in the Allis-Chalmers 16000 or 21000 engines over units of comparable size. He'll tell you why they run cleaner . . . how they "sip" fuel to earn the title "industry's healthiest engines."

Six crater-shaped pistons develop 225 hp in the HD-21, 150 hp in the HD-16 . . . both at an easy 1825 rpm. Coupled with torque converter drive, they provide plenty of rough dozing lugability . . . plenty of side boom liftability.

These big Allis-Chalmers tractors are built for mighty tough service . . . right-of-way pioneering, stringing, cradling, or lowering-in. Shock-absorbing all-steel main frame, durable double-reduction final drives, certified permanent lubrication of tapered roller bearing truck wheels, idlers and rollers, and extra tough track keep them going season after season with a minimum of maintenance. Your Allis-Chalmers construction machinery dealer will be glad to show you an HD-21 or HD-16 soon. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

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D/ST.B/715

Macks are the muscles of the oil fields. Here one of Bill Hodges' B-61 Model Macks places heavy machinery at drill site. Rutted, muddy footing is taken in stride because **Mack oil field trucks are built for oil field work.**

MACK for over 7 straight years NO.1 by far in sales of diesel trucks

Oil field trucker Bill Hodges says

"We use the best equipment we can buy"

"It doesn't pay to fool around with 'bargain' equipment in the oil fields," says Bill Hodges, head man at the Oklahoma City trucking company that bears his name. "Hundreds of rig moves have taught us the value of quality equipment. From trucks on down, every piece of equipment we use is one grade – the best."

Bill Hodges Truck Co. operates dozens of Macks . . . has units to handle loads up to 160,000 lbs. Macks have the capacity, the power, the rugged strength and flexibility to deliver rigs, equipment and machinery where they're wanted, when they're wanted. Mack-built Thermodyne® engines—gasoline or diesel—are unexcelled for long life, dependability and fuel economy. Mack-built transmissions are available up to 20 speeds, and are built to accommodate power takeoff units. On 6-wheel units, Mack's Balanced Bogie with Power Divider allows Mack trucks to move the heaviest loads over the roughest oil-field terrain by automatically applying controlled torque to the axle with greater traction.

In oil field work where more is demanded of a truck, you'll get more out of a Mack. Your Mack branch or distributor will be glad to show you why. Mack Trucks, Inc., Plainfield, New Jersey. Mack Trucks of Canada, Ltd., Toronto, Ontario. 7714

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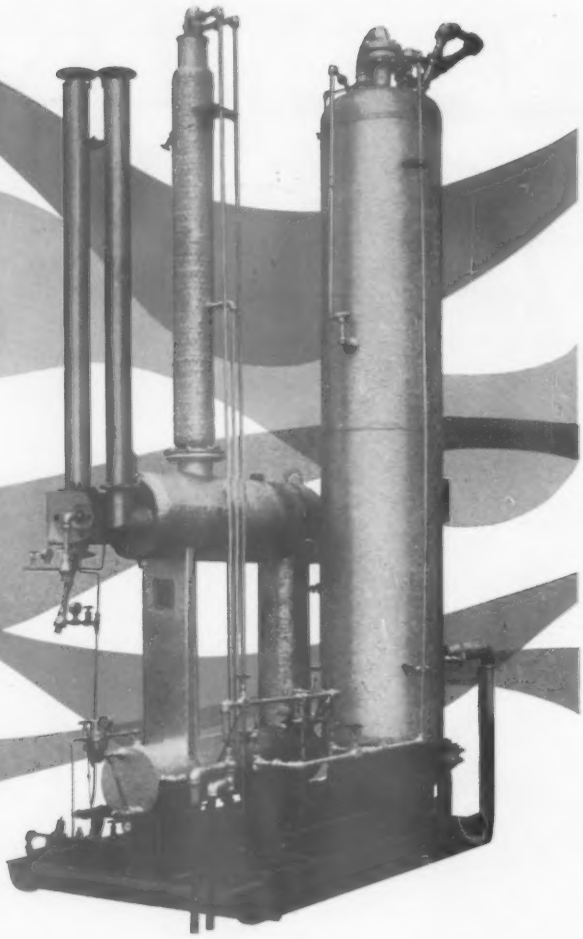
under Any Conditions



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For the most complete and versatile line of glycol dehydrators, look first to Parkersburg, the "full line" company. Available are the **conventional dehydrators** with guaranteed 65° F. dewpoint depression . . . **super-dryer dehydrators** for super-dewpoint depressions, high-temperature dehydration and lower reboiler temperatures . . . and the low-cost **concurrent-flow dehydrators,** including the small Mighty-Mite with the big capacity and the winterized horizontal or vertical DST units. Let Parkersburg engineers recommend the type of dehydrator best suited to produce your gas stream. Whatever the condition, depend on a Parkersburg Glycol Dehydrator for maximum production with maximum economy.

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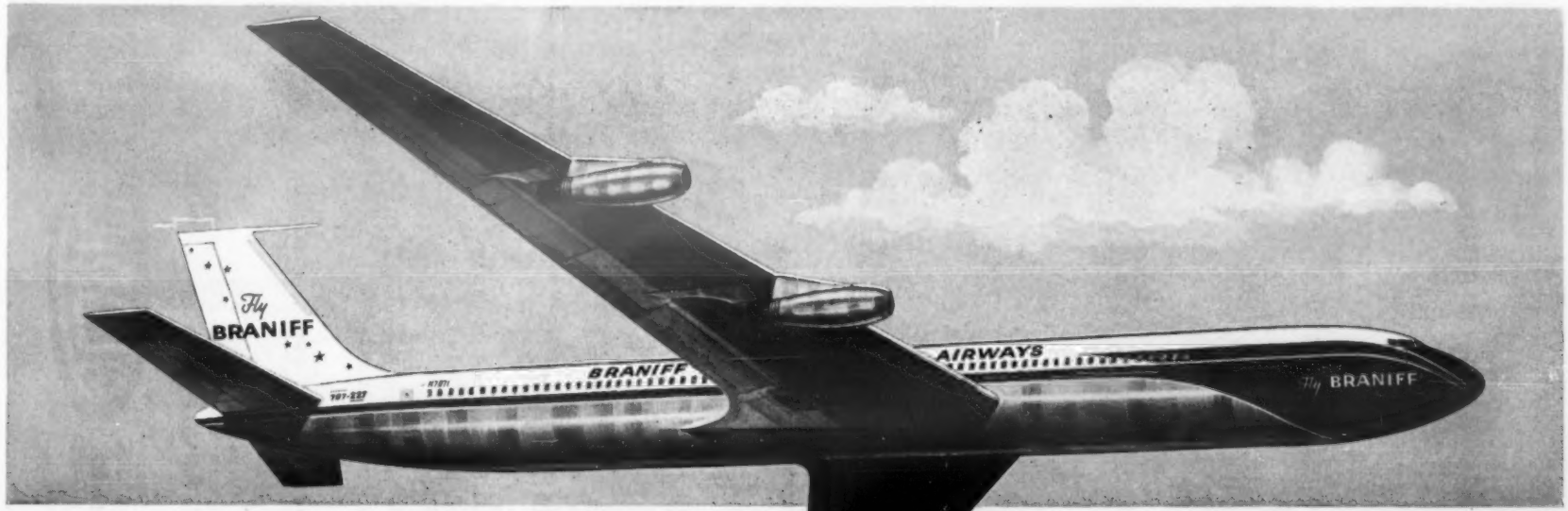

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FIELD REPORT

FLOOD: New Harmony Unit

OPERATOR: Superior Oil Company

PUMPS: 4 Aldrich Quintuplex

FLOODING STARTED: May, 1957

EXPERIENCE TO DATE: Pumps continuously deliver mixture of fresh and produced water to two formations — 16,000 bbl/day at 1,450 psi.

Customer reports: "Aldrich pumps were selected because previous experience plus new improvements indicated that they better fulfilled our requirements.

"Pumps handling fresh water only have not been repacked since operation began thirty months ago."

Field parts stock available in Carmi, Ill.; Calgary; Casper, Wyoming; Charleston, W. Va.; Houston; Los Angeles; Odessa and Tulsa. For further information, write the ALDRICH PUMP COMPANY, 9 Gordon Street, Allentown, Pa.

the tough pumping problems go to ALDRICH

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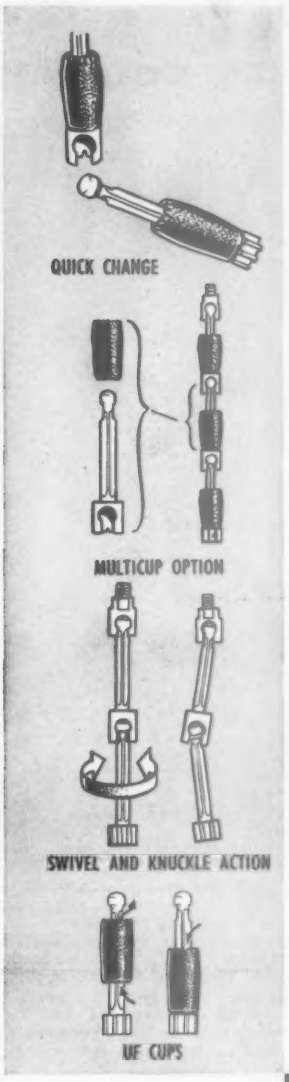
- ☐ 727 New Unit Rig Gray
- ☐ 724 Waukesha Gray
- ☐ 721 National Blue
- ☐ 723 Oil Well Orange

CUT COSTS..SPEED-UP SWABBING with NEW

GUIBERSON Knuckle Joint Tubing Swab

and SENSATIONAL MULTI-PURPOSE UF CUPS



QUICK CHANGE — New ball-and-socket design, another Guiberson first, lets you change cups in *ten seconds* with the swab hanging on the line . . you don't even have to lay the swab and sinker bars down. No pipe wrenches or other tools are required. This one feature reduces cost tremendously . . but that's not all . .

MULTICUP OPTION — Add a cup and upper mandrel . . as many as desired. No need to carry several different swabs . . no time lost in changing swabs. There are only five parts in a two cup swab . . sub, cups, upper and lower mandrels. Heat-treated steel parts are individually tested to withstand heaviest swabbing loads.

SWIVEL AND KNUCKLE ACTION— You get full 360° swivel at the bottom socket joint and 5° knuckle action at every joint. With any number of cups and even in crooked tubing, the combination of knuckle action and ample bypass makes this the fastest-falling swab ever run.

UF CUPS — Are strong, flexible, long life . . made from special compound with a valve ring molded in the base. Thus, new valves are obtained each time the swab is redressed. Cups travel freely on the mandrel, allowing bypass inside and outside the cup in the up position . . sealing perfectly in down position. The UF cups, designed especially for the knuckle joint swab, are strongly reinforced for heavy loads . . flexible enough for light loads . . small enough for tight tubing. Use the knuckle joint swab with UF cups and lift more fluid in fewer trips.

SAVE MONEY ON YOUR NEXT JOB WITH THIS SWAB

Sold by OIL FIELD SUPPLY STORES EVERYWHERE

THE

GUIBERSON

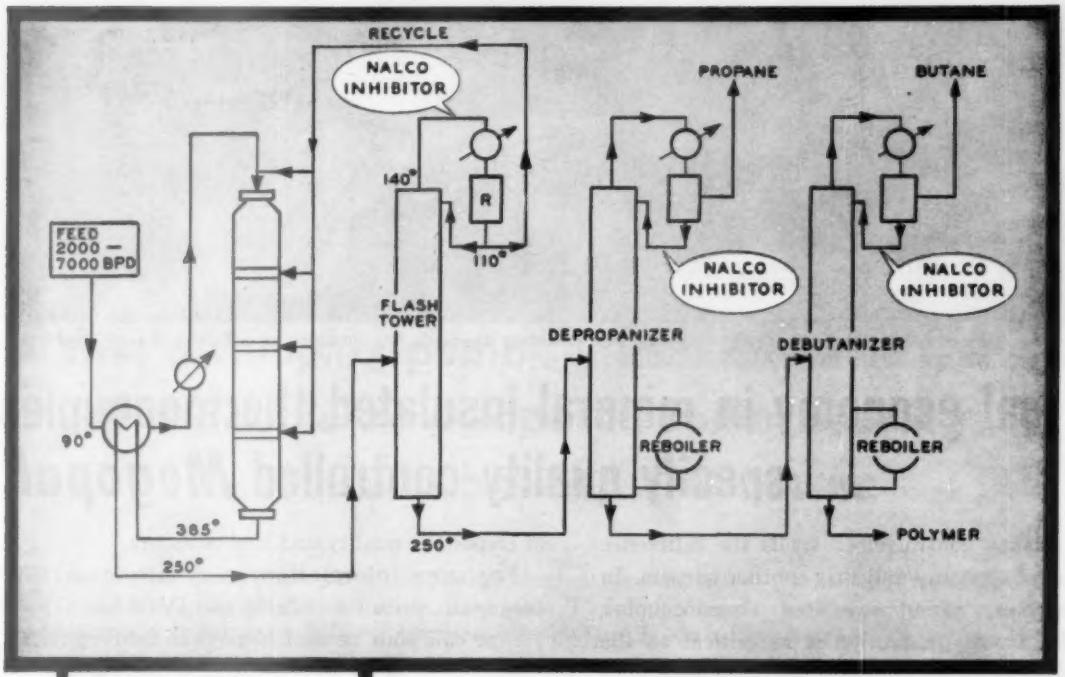
CORPORATION

ESTABLISHED 1919 — DALLAS, TEXAS U. S. A.

Nalco INHIBITORS

STOPPED CORROSION and FOULING

in this CATALYTIC POLYMERIZATION UNIT



THE PROBLEM

1. *Corrosion* of the steel tube bundles of the flash tower overhead condenser with accumulator water pH of 4.5 or below.
2. *Serious fouling* of screen trays in the depropanizer and debutanizer on normal six-month run.

THE TREATMENT

Nalco Inhibitor fed to the overhead of the flash tower, and to the reflux of the depropanizer and debutanizer towers.

THE RESULTS

1. Iron content of accumulator water reduced from .75 pounds per day to .04 pounds per day.
2. No deposits in screen trays after six-month run.

CONSIDER further the economy of dosage . . . 10 ppm to flash tower, and 10 ppm to depropanizer and debutanizer. And bear in mind that this was no isolated success story. The same advantages—less downtime, better thruput *and* effective protection for costly equipment—can be brought to your refinery by the use of Nalco Corrosion and Fouling Inhibitors. Ask your Nalco Representative or write direct.

National Aluminate Corporation is now

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6242 West 66th Place • Chicago 38, Illinois

Subsidiaries in England, Italy, Mexico, Spain, Venezuela and West Germany

In Canada—Alchem Limited, Burlington, Ontario

THE Nalco® SYSTEM . . . *Serving Industry through Practical Applied Science*

Nalco CHEMICALS

100% inspection of *MegopaK* thermocouples insures strict adherence to factory standards. Manufacturing area is clean, dry, air-conditioned.

Get real economy in mineral-insulated thermocouples . . . specify quality-controlled *MegopaK*

Careful quality control often spells the difference between *real* economy and just another bargain. In small-diameter, mineral-insulated thermocouples, where the art of production is as critical as the science, strict quality control is your only assurance of consistent quality and real economy.

For more information on quality-controlled *MegopaK*, write for Catalog and Price List G100-4 . . . or call your nearest Honeywell field engineer.

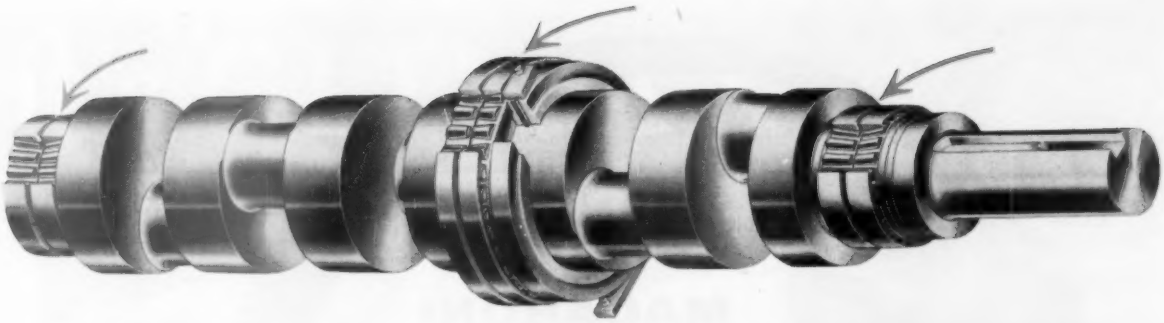
75th YEAR
PIONEERING THE FUTURE

Honeywell
First in Control
SINCE 1885

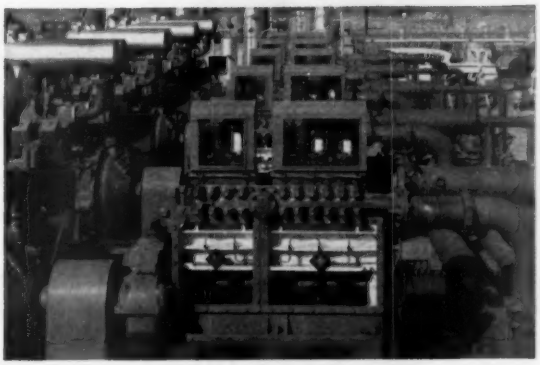
Insulators are stored in paraffin-sealed boxes, then baked to remove last trace of moisture. Assemblers wear gloves to prevent contamination of thermocouples.

Single-pass swaging of carefully-sized wire-insulator-sheath assembly produces no distortion in wire, insures greater accuracy and longer life.

Continuous hydrogen-annealing not only produces a ductile, brightly finished product, but also identifies improperly compacted material which is rejected during inspection.



Get smoother, maintenance-free operation...



on first quintuplex pump to use 3 double-row tapered roller bearings

...Timken® bearings, of course

WHEN Ajax Iron Works designed this quintuplex pump, it was an important first in the field. They use three double-row tapered roller bearings on the crankshaft to get smoother operation, eliminate field adjustment. And they're *Timken*® bearings. The double-row Timken bearings are naturals for the steady, heavy-duty work of the most severe oil field and industrial pumping. And like all Timken bearings, they assure longer bearing life and practically maintenance-free operation. Here's how they do it.

1) Timken bearings take *both* radial and thrust loads. Their tapered construction does it. They hold shafts in positive alignment, minimize deflection and end play.

2) Designed and precision-made to have true rolling motion, Timken bearings practically eliminate friction. They *roll* the loads.

3) By holding shafts concentric with housings, Timken bearings make closures more effective in keeping lubricant *in*, dirt, dust and moisture *out*.

4) Because steel is the heart of a bearing, we use only the finest.

To get better machines, make sure they're equipped with Timken tapered roller bearings.

When you buy Timken bearings you get...

1) Quality you can take for granted.
2) Service you can't get anywhere else.
3) The best-known name in bearings.
4) The pace setter in lower bearing costs.

The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.* Canadian Division: Canadian Timken, St. Thomas, Ontario.

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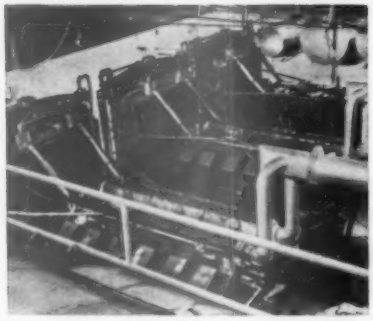
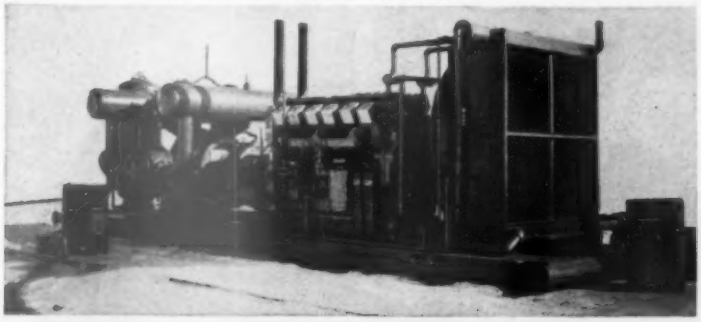
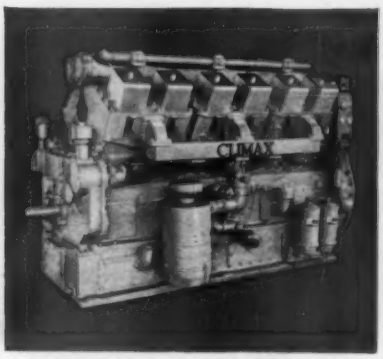


● Climax Engines have proven their reliability in hundreds of oil field installations. Single, well balanced design, rugged construction, and quality materials make them smooth running . . . for years!

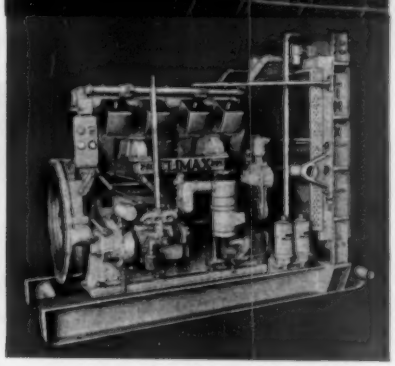
for COMPRESSORS



Model K-67—Max. hp 265 (Natural Gas)



Model V-125—Max. hp 605 (Natural Gas)



Model V-85—Max. hp 390 (Natural Gas)

CL-116

CONT. DUTY (NAT. GAS) →			DRILLING-PUMPING (80% RATINGS)						COMPRESSORS (65% RATINGS)				
Model	Bore & Stroke	Displ.	Peak Torque @ RPM	Brake hp at Speeds Indicated					Peak Torque @ RPM	Brake hp at Speeds Indicated			
				600	800	900	1000	1100		800	900	1000	1030
R-165	6⅛ x 7	1238	684 @ 750	81	105	117	127	135	557 @ 800	85	95	103	105
K-67	7 x 7	1616	955 @ 850	110	145	161	176	188	775 @ 800	118	131	143	146
K-75	7½ x 7	1855	1090 @ 800	126	166	185	204	218	885 @ 800	135	151	166	169
V-80	7 x 7	2155	1240 @ 850	140	188	210	230	246	1002 @ 800	153	171	187	190
V-85	7½ x 7	2474	1460 @ 800	164	223	246	266	284	1185 @ 800	181	200	216	221
V-122	7 x 7	3232	1920 @ 800	217	293	328	353	378	1562 @ 800	238	265	288	293
V-125	7½ x 7	3711	2240 @ 850	242	340	384	417	442	1820 @ 900	276	312	340	346

CLIMAX ENGINE MANUFACTURING CO. • DIVISION OF WAUKESHA MOTOR COMPANY
FACTORY—CLINTON, IOWA

ON SUBMERGED LINES–

Chiksan Swivel Joints flex freely with wave and tidal action

Swift tides and pounding waves make *flexible* offshore lines mandatory. To fill these requirements, producers turn to Chiksan Swivel Joints. Chiksan Joints in submerged service safely handle all maximum operating and surge pressures and provide the right degree of line flexibility to meet any tide and wave conditions. Moreover, Chiksan Joints are designed for salt water service and years of attention-free performance is common. Chiksan Joints and their partner Weco Unions are sold by leading supply stores everywhere.

#59-44

CHIKSAN fmc

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When rig-up starts . . . a stock check-up starts here

When you move a rig to a new location, folks in the nearest National Supply store go into action to *help you reduce down-time!*

This job calls for STOCKING vital parts that you might need in a rush . . . and DOING this job calls for a constant check of inventory to spot any gaps, and then ordering all items required.

This isn't all of the story, by any means. If any unanticipated breakage occurs, an immediate check is made with other stores in the district to find out where the necessary part can be obtained most quickly. Our nationwide teletype network lets us check availability with all 120 outlets.

The stocking of repair parts is only part of National Supply's store service. We purchase equipment and supplies from thousands of different sources—but all items have one thing in common. Every product we handle is trade-marked with the brand of established, reputable manufacturers, such as Byron Jackson, Chiksan, Ray-O-Vac and Clayton Mark.

Read about National Supply pump products on next pages

All National pumps are thoroughly inspected and tested before shipment. Photo shows new H-1250 pump undergoing extensive testing at National's Gainesville, Texas, pump test stand. This test stand is capable of transmitting up to 1400 input horsepower.

HOW TO REDUCE MUD SYSTEM

H-1250. National's engineers used new approach in designing power end frame for H-1250 slush pumps. Streamlined, strengthened box-type unit will withstand all pressures of severest service. Unique design features result in reduced cylinder bore wear, longer liner packing service, longer life for connecting rod and main bearings, fast and efficient lubrication.

K-500. This completely new 513 input horsepower slush pump provides a high degree of accessibility which simplifies and speeds up routine maintenance operations. "Fast change" screw type valve covers and threaded cylinder head arrangement permit rapid removal of all fluid end parts, without removing cylinder head body. Write for new Bulletin No. 500.

New National H-1250 Power Slush Pump combines high strength with light weight, compactness

Advanced design of National's H-1250 power slush pump meets all requirements of modern jet drilling. Yet all features retain the durability that is traditional in National Supply pumps.

Here are a few of the H-1250 features that pay off in long, trouble-free service:

LIGHT WEIGHT. Main frame is fabricated of formed steel plates, structurals and castings, welded in a tight unit with high structural rigidity. The H-1250 is very portable, due to light weight in relation to its 1,250 input horsepower.

LONG PACKING LIFE. Liner and cylinder head packing last longer . . . can be independently adjusted without disturbing metal-to-metal fluid cylinder liner arrangement. New dual cage fluid end design reduces cylinder bore stresses.

IMPROVED FATIGUE LIFE. Reduction in cylinder bore stresses is achieved as new design reduces by nearly one half the length of the bore exposed to fluid pressure.

It will pay you to investigate the many new features of National's H-1250 slush pump. Write for Bulletin No. 502, or call your nearest National Supply representative.

Steel

Steel's Symbol of strength, long life, and economy

National Fluid End Parts on next page

COSTS WITH NATIONAL PUMPS

K-700. This new National power slush pump is exceptionally light in weight for the 700 input horsepower rating. Design incorporates same fluid end innovations as the K-500. Fluid end is a one-piece steel casting with streamlined internal passages. Cylindrical sections give maximum strength. Each fluid end is given a thorough hydrostatic test before final assembly. Write for new Bulletin No. 501.

PULSATION DAMPENERS. The National Pulsation Dampener is made without troublesome rubber diaphragms, bags or sleeves. Only rubber element is an inexpensive valve disc that can be replaced in minutes. Rig air supply operates the dampener without need for high pressure air supply or nitrogen for pre-charging. National Pulsation Dampeners are available as original equipment or for field installation.

Careful packaging and shipment of National Fluid End parts assure delivery in factory-perfect condition.

National Fluid End Parts are readily available when and where you need them

National Supply has utilized its facilities and experience as a leading pump manufacturer to develop a complete line of fluid end parts for your use. Every part meets the most exacting quality standards.

DUAL SEAL PISTON

Incorporates two replaceable piston rubbers, forming an inner and outer seal at each end of the piston. Void between the rubbers allows space for displacement, minimizes damage to piston lips as it enters liner. Heavy fabric section molded into the back of inner rubber dams off extrusion around the OD of hub, and reduces pinching of the rubber. Forged steel hub of piston resists expansion under extreme loading.

FLUID PISTON ROD PACKING

Fluid pressure actuates the sealing lips. The greater the pressure, the tighter the seal . . . yet the solid make-up through the body of the packing minimizes the danger of overtightening it when it is installed. Rod wear is sharply reduced, because lip pressure is never excessive . . . in fact, it is negligible on the suction stroke.

FLUID CYLINDER LINERS

The ID of the Nationaloy Liner is case hardened throughout its length. Precision honing gives it maximum resistance to wear, washing and abrasion. Outside surface is machined to close tolerances, promoting closely controlled fits which reduce piston and rod wear due to misalignment.

FLUID CYLINDER LINER PACKING

Resistant to oil, gas heat and chemicals, National Liner Sleeves provide a perfect seal between the liner and pump bore. They are sufficiently hard to be confined in the packing space . . . preventing excessive flowing and pinching . . . yet they retain ample resiliency for proper sealing action.

"BLUE STRIPE" AND "BLUE CHROME" PISTON RODS WITH API TAPERS

Have maximum tensile strength and high resistance to impact. Precision ground and polished to reduce wear of both packing and rod. "Blue Chrome" Piston Rods have a super-hard, abrasion-resistant chrome finish which gives added packing and rod life under all conditions.

TYPE G-2 FLUID VALVES AND SEATS

Promote maximum pump efficiency, with maximum effective opening for fluid flow to permit complete filling at high speed. The lower guide . . . integral with the valve . . . has a large contact area which reduces wear and minimizes the possibility of cocking. A heavy clamp plate and lock gives longer valve life.

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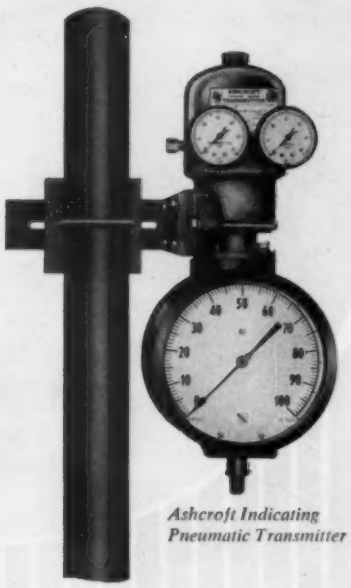
ASHCROFT PNEUMATIC TRANSMITTERS give you a true primary and transmitted signal for indication or control



Ashcroft Indicating Pneumatic Transmitter

action

Now—detect with precision accuracy the slightest change in primary pressure or temperature. Transmit this signal quickly to your indicators or controllers. Ashcroft Pneumatic Transmitters achieve these results for you at the lowest initial and operating costs.

Full-range, solid-front indicating and totally accessible nonindicating transmitters eliminate the need for costly high pressure lines, yet permit complete monitoring of process conditions in remote areas.

Narrow-span Ashcroft Transmitters are expressly designed with highest sensitivity and repeatability for the most accurate primary signal feed to controllers. You get better control and purer, lower-cost final products.

Only in Ashcroft Pneumatic Transmitters can you get the wide choice of Ashcroft Duragauge Bourdon tubes or American mercury or gas-actuated systems for sensing pressure or temperature conditions. You also get a time-proven, obstruction-proof, force-balance, nonbleed relay for economical, maintenance-free 3-15 psi or 3-27 psi signal transmission.

Write for factful Bulletins 360 and 361 or ask your nearby Ashcroft Distributor to help you select the right transmitters and receiver gauges for your specific requirements.

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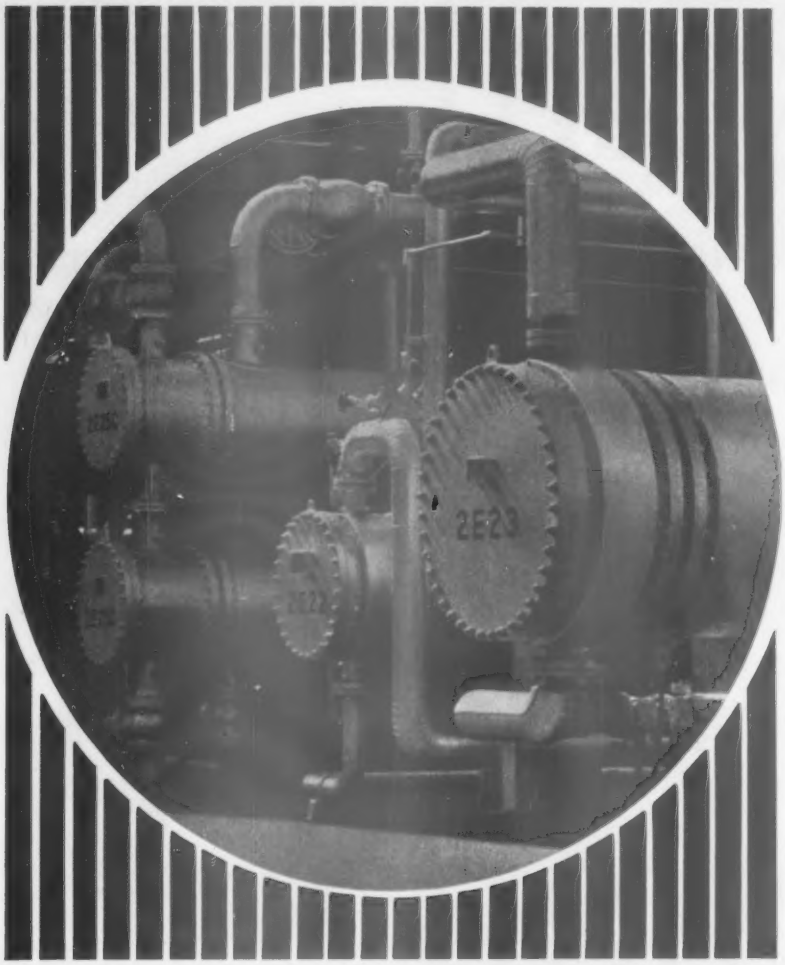

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View from an oilman's club in Houston of the Gulf Building, home of The National Bank of Commerce.

See It to Believe It

A healthy skepticism is a good thing, whether it is concerned with a friend's version of his fishing trip or whether a salesman is trying to take you to the top of the mountain.

But, whatever skepticism you may have about the future of Houston as an important oil center will vanish when you see what's going on here. The domestic operations for many major oil companies—Texaco, Humble and the Jersey group, Gulf, and Continental—are being domiciled in Houston. Others—such as Shell, Mobil, Pure, and Tidewater—maintain large offices. And more and more oil companies are finding it to their advantage to maintain a listening post here.

To keep in the center of domestic oil activity you, too, should consider an office in Houston. That's where we come in. As the principal bank for many of the largest companies in this area, The National Bank of Commerce of Houston is in a position to help you with contacts, advice, and, of course, all banking services.

The Oil and Gas department is qualified to help you in all fields of activity. Working closely with other bank departments—Loan, Trust, International Banking, Investment—you will find the same sort of service waiting for you that has made this *the* bank of Houston oil men.

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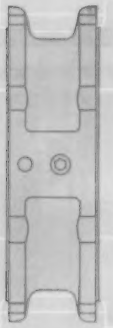
fits between the flanges



less space—weighs only 10% as much

Mission Duo-Chek valves

Mission Duo-Chek Valves weigh approximately 10 per cent as much as conventional check valves. Smaller, lighter Duo-Chek Valves mean that you save on space, weight, installation, and price. But, you are getting a check valve with a bubble-tight seal, anti-slam closure, long life built in. No load is carried on the plate hinges. No external parts. No lubrication required.

The sine wave seal prevents seepage, yet holds without leaking or distortion at maximum test pressure. The sealing material is molded and bonded into a metal groove, making an "O"-ring type seal. Pressure deforms the packing. Metal-to-metal contact completely encloses the sealing material, preventing pinching off under pressure. Available in steel, 316 stainless, aluminum, and bronze to fit ASA raised face or ring joint flanges.

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They Say—

Union ranked fifteenth

Dear Sir:

This refers to the tabulation of 35 oil companies on pages 80 and 81 of the April 11 issue of The Oil and Gas Journal ("Economy Drives Made '59 a Good Year in Spite of Problems").

The amounts shown for Union Oil Co.'s assets for 1959 and 1958 are incorrect. They represent our shareowners' equity (assets minus liabilities) and not total assets. Our total assets at the end of 1959 and 1958 were $707,166,446 and $684,557,856, respectively.

On this basis our position at the end of 1959 would be fifteenth instead of nineteenth as you have indicated.

E. H. Golisch
Supervising Accountant,
Corporate Accounts
Union Oil Co. of California

Out-of-date terms

Dear Sir:

Your article in the April 25 issue on Alaskan petroleum activities ("Soldotna Discovery Gives Alaskan Oil a Needed Lift," p. 197) was of particular interest to me, and I congratulate you on your continuing and increasing coverage of Alaska.

However, in this issue and in previous articles you have used northern Alaska stratigraphic names that are considerably out of date. I am, therefore, enclosing two reprints which outline the most recent Cretaceous terminology.

Your Paleozoic stratigraphy of northern Alaska is likewise out of date, and I am also enclosing a copy of U. S. Geological Survey Professional Paper 303A-B on this subject.

George Gryc
Staff Petroleum Geologist
Branch of Alaskan Geology
U. S. Department of the Interior

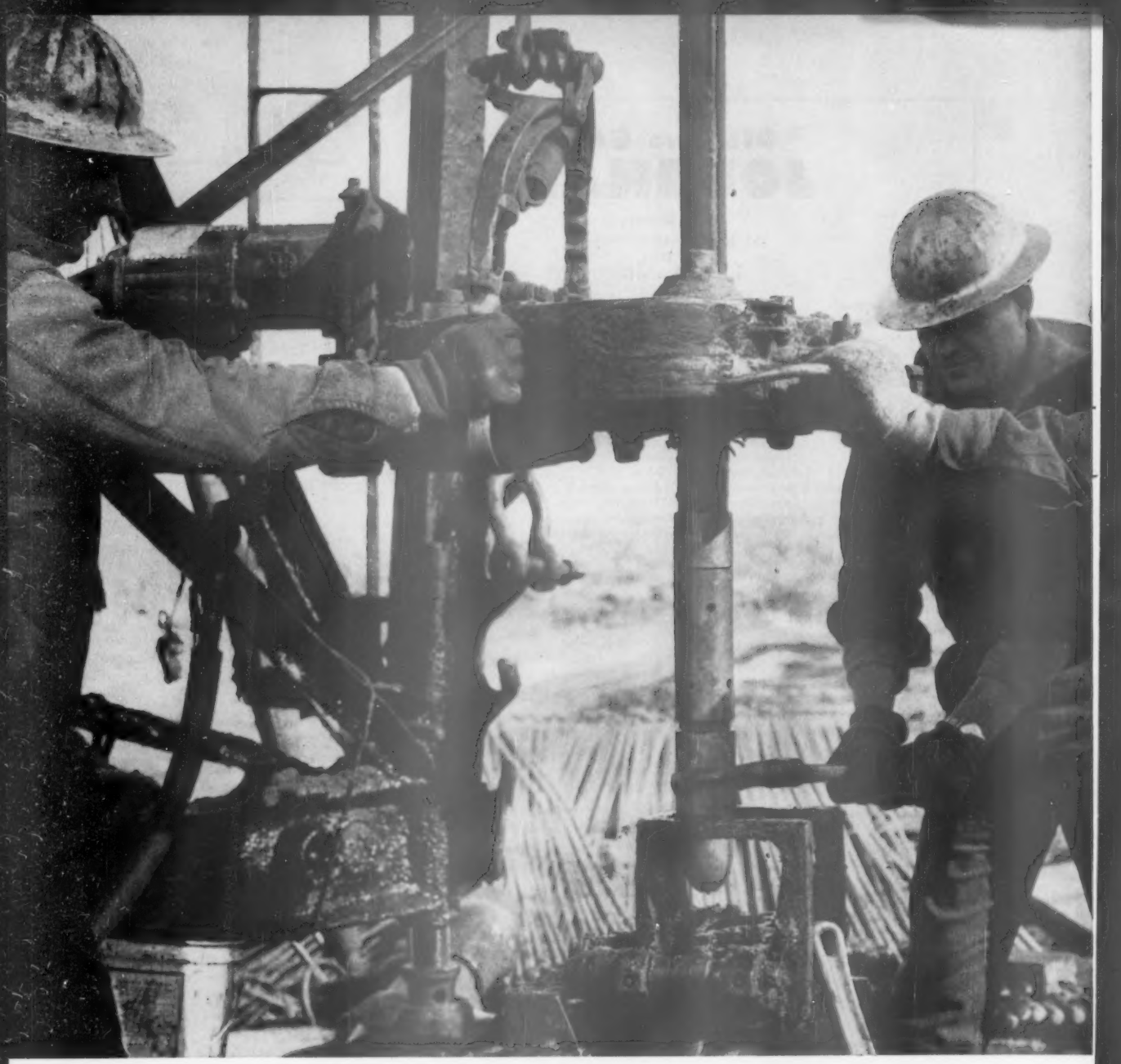
(Editor's note: Thanks. We've revised our charts).

Equation trouble

Dear Sir:

I have read with interest the article by E. A. Hartsook on "A Fast Way to Evaluate Reserves" (OGJ, Mar. 28, p. 200). I believe he is on the trail of a good idea, but I had difficulty in determining just what his secret formula is.

Near the top of the center column



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Abrasijet* is a new Dowell-developed formation cleaning and perforating service. It uses high-velocity streams of fluid and abrasive particles, usually sand (pumped through small jet orifices in the tool pictured above) to perforate casing or cut through well bore damage. Water, oil, acid and mud have been used as the sand-carrying fluid.

Reports from field after field show that Abrasijet gives better results than more conventional treatments in many instances. These same reports also show that Abrasijet has been successful in cases where all other treatments failed. Here are a few examples:

IN SOUTH TEXAS. Abrasijet was used to re-perforate a Wilcox well and penetrate beyond gyp deposited near the well bore. Production had dropped to 10 bopd on gas lift. Five sets of two perforations per level were jetted using Dowell inhibited acid and sand. *Production rose to 96 bopd with 880 psi flowing pressure.*

IN NORTHWESTERN NEW MEXICO. *Abrasijet was used to complete a 260 bopd flowing well in an area surrounded by dry holes.* Completion was into a 22-foot section of the Dakota. Abrasijet was employed to make 48 perforations in twelve settings of a four-jet tool. Well was also fractured in the basic eight-hour pump-rental time.

NEW IDEAS FROM DOWELL

TO HELP YOU MAKE MORE PROFIT

"ACID GUIDE"*

This new companion to the "Frac Guide"* is used by Dowell for *better* engineering of acid treatments. Results have been greater production increases, lower treatment costs, or both. Probable results of acid treatments can be predicted, and the most promising treatment selected for a given well.

CORROSION INHIBITOR SQUEEZE

This Dowell-developed technique for inhibiting corrosion in oil wells has given excellent long-term protection with minimum cost of application. Second and later applications of Corban* inhibitor by "squeezing" it into the producing formation have been even more efficient than the first.

FOAMING AGENT FOR WATER REMOVAL

This new Dowell addition agent can be added to water used in fracturing to induce foaming and reduce swabbing time. It is also used to facilitate air or gas drilling through low-production water zones. For air drilling, it minimizes "balling" of cuttings and creates a foam for easier water removal.

IN SASKATCHEWAN, CANADA. *A well was successfully perforated with Abrasijet after two attempts at explosive perforating had failed.* 4½-inch casing had been cemented through the Mississippian pay from 2318 to 2323 feet. Four perforations were made followed by a frac job. *One month later production was averaging 70 to 80 bopd in a field where most wells average only 50 to 60 bopd.*

IN CENTRAL KANSAS. *A well that produced only water on initial completion was recompleted successfully with Abrasijet.* A radioactive survey showed a channel from initial perforations at about 3318 feet to bottom of casing at 3405 feet. Well was squeezed with cement to shut off water. Abrasijet was used to reperforate without shattering cement. New perforations were from 3323 to 3329 feet. *After acidizing, well tested 6.5 boph with only a trace of water.*

The chances are good that you can increase your profits with Abrasijet. For prompt service or detailed information on Abrasijet, *dial Dowell.* There are 150 offices and stations in the United States, Canada, Argentina and Venezuela. Dowell, Tulsa 1, Oklahoma.

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Services for the oil industry

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THIS 140' LEE C. MOORE 3-WELL DERRICK HAS A GROSS NOMINAL CAPACITY OF 1,100,000 LBS., AND 100 M. P. H. ACTUAL WIND LOAD CAPACITY WITH PIPE STACKED IN DERRICK.

A series of wells can be drilled from one setting of a Lee C. Moore multiple well derrick and, except in the case of the twenty-five well derrick, without moving drawworks and power. Leg capacities are designed to withstand eccentric loading of multiple well drilling operations.

Lee C. Moore multiple well derricks are available in two-well, three-well, four-well, six-well and twenty-five well sizes.

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on p. 200 there are some equations that contain c and C. These are not defined. Furthermore, the sentence containing the formula includes an excess comma.

Harold H. Sullwold, Jr.
North Hollywood, Calif.

(Editor's note: The c's should all be lower case, and c is defined mathematically on p. 200. No word definition is necessary, according to the author. The comma is s u r p l u s, all right, and we found another error, too. Equation 8, p. 202, s h o u l d read: $PW=0.58\ PV_o{}^{n}c^{n}$.)

OU deserves credit

Dear Sir:

The University of Oklahoma feels honored that you saw fit to publish one of the papers presented at our advanced petroleum engineering seminar (OGJ, May 9, "How to Finance Oil and Gas Production," by Greg Ireton, p. 165).

But shouldn't we have received a credit line?

John M. Campbell
Head, Department of Petroleum Engineering
University of Oklahoma

(Editor's note: Absolutely, especially since we told the university there would be a credit line. Our apologies for this oversight).

A good one

Dear Sir:

The article by Greg Ireton (OGJ, May 9, p. 165) is a good one. He handled the problem of oil financing well.

The use of the "flow sheet" above the title to explain the ABC deal was effective.

Wayne E. Swearingen
Swearingen Engineering Co.
Tulsa

Errors here and there

Dear Sir:

My article, "Lab Studies Shed Light on Compressor-Cylinder C o o l i n g," (OGJ, April 18, p. 138) contains errors as follows:

1. Test point 2 in Fig. 2 should be underlined.

2. Figs. 4 and 5 are transposed. Captions for the figures are correct as printed.

3. In the section headed by "4 Horsepower," second column, p. 141, second sentence, "run 2" should read "run 14." This was incorrect on manuscript furnished you.

4. Ordinate for Fig. 4 (corrected) should be "Thousands of B.t.u./hr."

AMERCOAT: COMPLETE CORROSION PROTECTION

No one coating is ideal for all applications. A coating which gives outstanding protection against chemical fumes in a refinery may fail completely when exposed to salt water splash, high humidity or hot sun on an offshore rig in the Gulf area.

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DIMETCOTE—a 100% inorganic, zinc silicate coating for severe weather exposure, salt water spray, fresh water, etc.
Typical applications: Offshore rigs, floating roof tanks, steel structures, pipelines, cooling tower piping, etc., and as a permanent primer.

AMERCOAT No. 33—A vinyl maintenance coating unexcelled for water immersion, chemical spillage or corrosive fumes.
Typical applications: Tank exteriors, pipelines, etc.

AMERCOAT No. 78—A catalyzed coal tar epoxy for exceptional resistance to severe chemical exposures.
Typical applications: Sour crude storage tanks, pipelines

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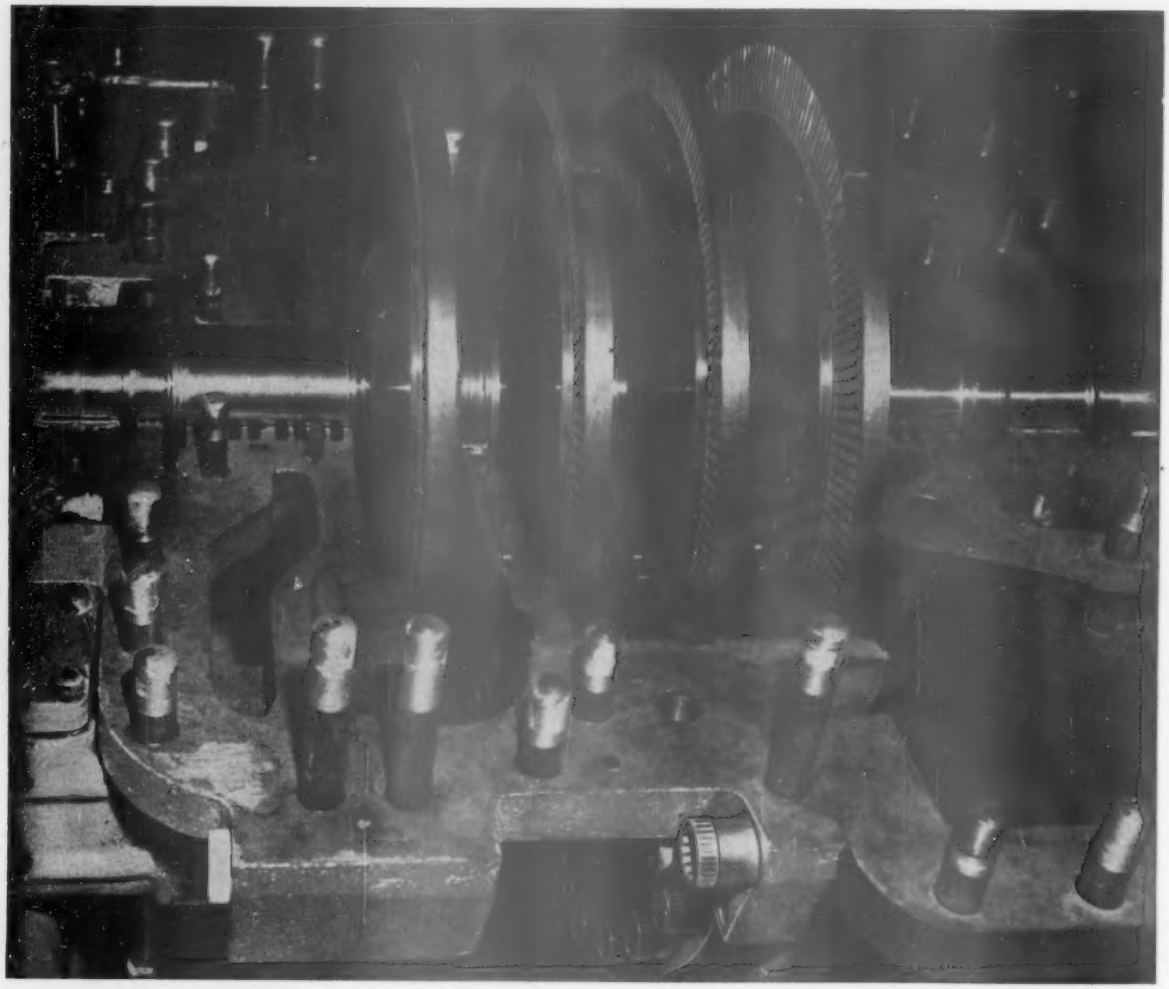

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DRIVE TURBINE REVEALS THE REASONS FOR MURRAY'S UNIVERSAL ACCEPTANCE

A look at MURRAY'S rugged construction from the inside shows the husky shaft and heavy accurately formed discs with generous sized hubs designed to withstand the axial and radial stresses imposed by this type of service.

Large-dimension disc rims receive the specially contoured stainless steel blades with the Murray integral shroud. This insures smooth steam passages with maximum strength.

Short bearing spans insure smooth operation and eliminate the hazard of operating in critical speeds.

A look at the heavy flanges and husky bolting in the actual unretouched shop photo shown above bears out the extreme ruggedness that typifies every feature of Murray construction.

Our nearest representative will gladly help you solve your high speed compressor drive turbine requirements. Just write to Murray Iron Works Company, Burlington, Iowa, for his name.

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TURBINES

MURRAY IRON WORKS COMPANY • BURLINGTON, IOWA
Builders of Steam Power Equipment for Nearly a Century

This was incorrect on manuscript furnished you.

5. Units for Item F, first, and second stage, of Table II should be (B.t.u./hr.) $\times 10^{-3}$, instead of B.t.u./hr. $\times$ 1D^{-3}. This was incorrect on manuscript furnished you.

6. In Fig. 6, the point for run 16, second stage, is not numbered.

W. F. Hartwick
Cooper-Bessemer Corp.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

MAY

22-25 National Association of Purchasing Agents, annual convention, Biltmore Hotel, Los Angeles.

22-26 Air Pollution Control Association, annual meeting, Netherland-Hilton Hotel, Cincinnati.

23-24 American Gas Association, production meeting, Roosevelt Hotel, New York City.

23-26 American Society of Mechanical Engineers, oil and gas power conference and exhibit, Muehlebach Hotel, Kansas City.

24-25 Western Petroleum Refiners Association, computer conference, Ben Milam Hotel, Houston.

24-26 American Right of Way Association, annual seminar, Shoreham Hotel, Washington.

25-27 Pacific Coast Gas Association, accident prevention and transmission conference, Hotel Utah, Salt Lake City.

25-28 American Association of Petroleum Geologists, western Canada regional meeting, Banff Springs Hotel, Banff, Alta.

26-27 Natural Gas and Petroleum Association of Canada, meeting, Niagara Falls, Ont.

JUNE

1-3 Texas College of Arts and Industries, fifteenth annual short course on gas technology, sponsored by Southern Gas Association, Kingsville, Tex.

1-3 West Virginia University, fifth annual Appalachian underground corrosion short course, Morgantown, W. Va.

2 Pennsylvania Grade Crude Oil Association, annual meeting, Pennhills Club, Bradford, Pa.

2-3 Kentucky Oil and Gas Association, annual meeting, Phoenix Hotel, Lexington.

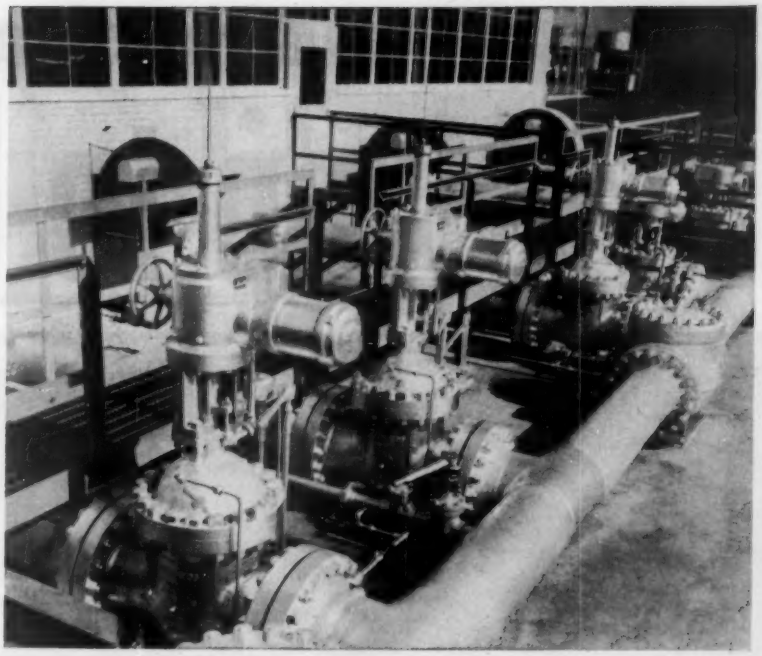
5-9 American Society of Mechanical Engineers, summer annual meeting, Dallas.

5-10 Society of Automotive Engineers, summer meeting, Edgewater Beach Hotel, Chicago.

9-11 Manufacturing Chemists' Association, annual meeting, The Greenbrier, White Sulphur Springs, W. Va.

13-15 American Association of Cost Engineers, annual meeting, Rice Hotel, Houston.

13-15 Chemical Institute of Canada, an-



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PERMANENT GOOD BEHAVIOR

The reason is very simple. These valves are different! They were designed with one objective uppermost—to be unaffected by the very conditions that lead to trouble in ordinary gate valves. And so it was that Darling came up with the fully revolving double disc, parallel seat principle. It minimizes friction and avoids wear concentration. It assures remarkably easy operation with self adjustment for positive closure. It automatically compensates for any valve body deflection.

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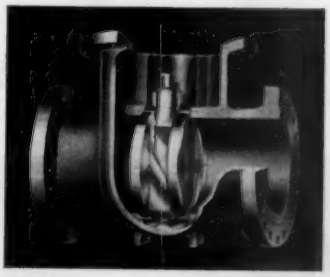

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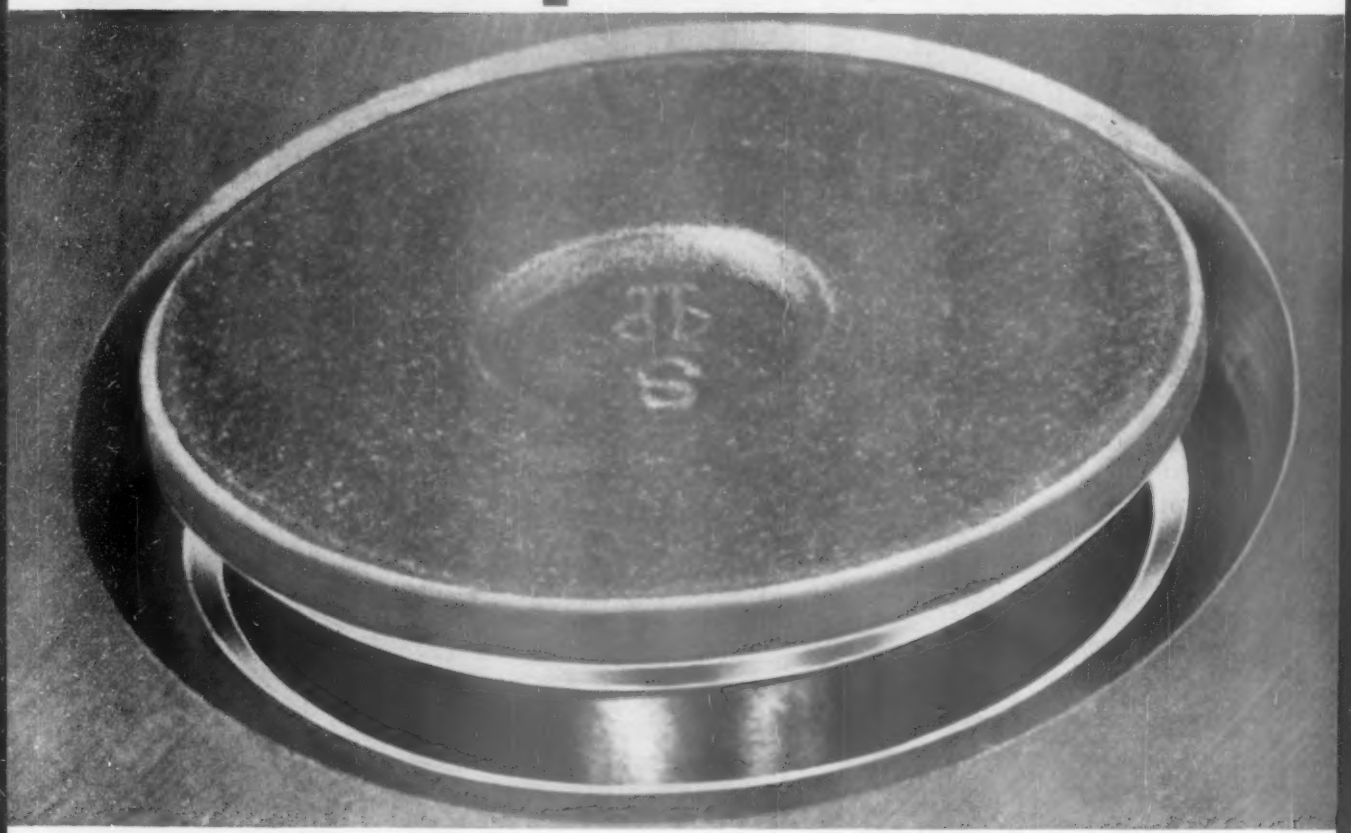

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Big, brawny bearings—twice the size of many competitors' bearings—give Onan Plants a longer life between overhauls. Onan is built *up* to performance, not down to a price.

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Stellite—one of the toughest alloys known—gives the exhaust valves and seats in an Onan engine up to 300% longer life. Scorching punishment—Stellite can take it.

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And, only Onan gives you Performance Certified. Every Onan Electric Plant is run for hours under full load before it leaves our factory to assure ourselves, and you, of getting all the performance and power you paid for. To give you even more assurance, inspectors from an independent laboratory come in periodically to double check our tests and testing methods. Whether you need primary or stand-by generating power, from 500 watts to 230,000 watts, see your Onan distributor. You'll find his name in the telephone classified section in every major city, or write direct.

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We guarantee that when properly installed and operated this Onan electric plant will deliver the full power and the voltage and frequency regulation promised by its nameplate and published specifications. This plant has undergone several hours of running-in and testing under realistic load conditions, in accordance with procedures certified by an independent testing laboratory.
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nual conference and exhibition, Chateau Laurier, Ottawa.

13-15 Interstate Oil Compact Commission, midyear meeting, Statler Hilton Hotel, Detroit.

15-16 Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Hotel Lassen, Wichita.

16-18 International Oil Scouts Association, annual meeting, Biltmore Hotel, Los Angeles.

19-22 American Institute of Chemical Engineers, Instituto Mexicano de Ingenieros Quimicos, joint meeting, Hotel Del Prado, Mexico City.

22-25 Canadian Gas Association, annual meeting, Manoir Richelieu, Murray Bay, Quebec.

22-25 American Association of Petroleum Landmen, national convention, Ambassador Hotel, Los Angeles.

22-July 1 University of Michigan, engineering summer conference, topics in multiphase flow, Ann Arbor, Mich.

25-29 Petroleum Equipment Suppliers Association, annual meeting, Banff Springs Hotel, Banff, Alta.

25-July 5 First International Congress for Automatic Control, Moscow, U.S.S.R.

26-28 North American Gasoline Tax Conference, annual meeting, southern region, Eden Roc Hotel, Miami Beach.

26-July 1 American Society for Testing Materials, annual meeting and exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J.

27-28 Michigan Gas Association, Mackinac Island, Mich.

JULY

11-20 University of Michigan, engineering summer conference, applied mathematics for chemical and metallurgical engineers, Ann Arbor, Mich.

18-29 Massachusetts Institute of Technology, dynamics and control of chemical engineering processes program, Cambridge, Mass.

28-30 American Petroleum Institute, Division of Production, Eastern district meeting, The Greenbrier, White Sulphur Springs, W. Va.

AUGUST

3-5 Wyoming Geological Association, field trip to Snyder basin and Wind River Mountains, Casper.

14-19 National Congress of Petroleum Retailers, Inc., annual session, Shamrock-Hilton Hotel, Houston.

15-17 American Society of Mechanical Engineers, American Institute of Chemical Engineers, heat transfer conference and exhibit, Statler Hilton Hotel, Buffalo, N. Y.

15-26 Sacramento State College, summer institute on nondestructive testing, Sacramento, Calif.

22-26 Gordon Research Conference, catalysis, Colby Junior College, New London, N. H.

29-31 Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va.

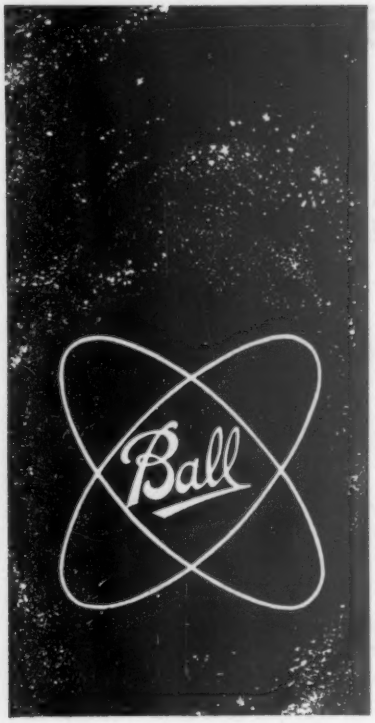
30-Sept. 2 American Association for the Advancement of Science, Alaska Division, eleventh Alaskan science conference, Anchorage.

SEPTEMBER

6-7 Chemical Institute of Canada, organic chemistry division conference, Edmonton.

7-9 American Society of Mechanical Engineers, joint automatic control conference, Massachusetts Institute of Technology, Cambridge, Mass.

8-9 National Research Council, Chemi-



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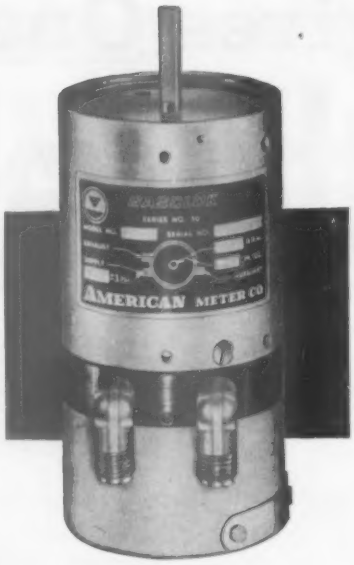

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Completely self-contained gas or air-powered instrument driving and timing unit for long, trouble-free operation in remote locations. The GASCLOK delivers more than 20 times the torque of conventional spring-wound mechanisms. Continuous timing accuracy is unaffected by a ± 20% variation in supply pressure.

Inherently explosion proof and self-starting, the GASCLOK is ideal as original or replacement equipment for strip chart and conventional circular chart instruments. The timing mechanism is internally sealed to prevent corrosion, and all power unit parts exposed to gas are aluminum or stainless steel. Large area internal ports prevent clogging. Normal air or gas consumption 5 cfh . . . operating pressure 5 psi . . . rotation 2 rpm.

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Run a torque converter on a drilling rig for over 22,000 hours without laying a wrench on it and your profits are bound to look good. Right?

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And that's exactly what Crow Greyhound Drilling Company of Shreveport, La., is doing by using TORQMATIC Converters on three of its drilling rigs. The converters on one rig have racked up more than 22,000 hours of trouble-free service. In all that time, *the only thing Crow Greyhound Drilling Co. did to the converters was normal preventative maintenance.*

But it's not just TORQMATIC's trouble-free performance that's saving money for Crow Greyhound Drilling Co. They're also drilling faster, making faster round trips, spending less on rig maintenance because of the "smoother than steam" power transmission. Inch-by-inch control saves time on fishing jobs–and drill strings last longer with TORQMATIC absorbing the shocks.

You can make more–save more–with TORQMATIC DRIVES working for you on your drilling, fracturing, or servicing jobs. They're available from most leading oil field equipment manufacturers. See your dealer for details, or write Allison Division, General Motors, Indianapolis 6, Indiana. In Canada: General Motors Diesel Limited, London, Ontario.

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THE MODERN DRIVE FOR MODERN EQUIPMENT

DUFF-NORTON Ratchet Jacks *are safer...last longer*

safer...

because the forged steel rack bar on Duff-Norton ratchet jacks is larger and stronger than the rack bar on any other make. Also, these jacks can not trip under load which guards men and equipment.

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because the exclusive spring mechanism makes maintenance easy. It is a patented self-contained, one-piece unit. It can be adjusted, repaired or replaced without taking the jack apart. Tension can be tightened by the turn of a screw. It can be cleaned by removing cover plate and four cotter pins. After years of service a worn mechanism can be quickly replaced.

Years of hard use are built into every one of the nine models—capacities range from 5 to 20 tons. For rugged, dependable, fast lifting power at minimum cost see your favorite supply store for Duff-Norton Ratchet Jacks.

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Hand Chain • Electric

cal Institute of Canada, tenth Canadian high polymer forum, Alpine Inn, Montreal.

8-9 Mid-Continent Oil and Gas Association, Louisiana - Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

8-10 Chemical Institute of Canada, western regional conference, Regina.

8-10 Intermountain Association of Petroleum Geologists and Eastern Nevada Geological Society, field trip, economic geology of east-central Nevada.

11-16 American Chemical Society, national meeting, New York City.

14-15 Western Petroleum Refiners Association, Rocky Mountain regional technical - industrial relations meeting, Henning Hotel, Casper, Wyo.

14-16 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

15 Natural Gasoline Association of America, Rocky Mountain regional meeting, Palliser Hotel, Calgary.

15-16 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual engineering management conference, Morrison Hotel, Chicago.

18-21 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Jung Hotel, New Orleans.

19-21 Texas Mid-Continent Oil and Gas Association, annual meeting, Hilton Hotel, San Antonio, Tex.

21-23 Pacific Coast Gas Association, annual meeting, Westward Ho Hotel, Phoenix.

23 Oklahoma Utilities Association, gas division meeting, Biltmore Hotel, Oklahoma City.

25-27 American Association of Oilwell Drilling Contractors, annual meeting, Roosevelt Hotel, New Orleans.

25-28 American Institute of Chemical Engineers, meeting, Mayo Hotel, Tulsa.

25-28 American Institute of Electrical Engineers, petroleum industry committee, electrical conference of the petroleum industry, Hotel Skirvin, Oklahoma City.

26-29 American Welding Society, fall meeting, Penn-Sheraton Hotel, Pittsburgh.

26-30 Instrument Society of America, instrument-automation conference and exhibit, and fifteenth annual meeting, Coliseum, New York.

29-30 Mid-Continent Oil and Gas Association, Mississippi-Alabama division meeting, Grand Hotel, Point Clear, Ala.

OCTOBER

2-5 Society of Petroleum Engineers of AIME, annual fall meeting, Denver.

3-4 Independent Natural Gas Association of America, annual meeting, Fontainebleau Hotel, Miami Beach.

5-7 Four Corners Geological Society, third field conference, registration, October 4, Moab, Utah.

6-7 National Association of Corrosion Engineers, annual western region conference, Sheraton-Palace Hotel, San Francisco.

6-8 National Association of Corrosion Engineers, southeast region conference, Dinkler-Plaza Hotel, Atlanta, Ga.

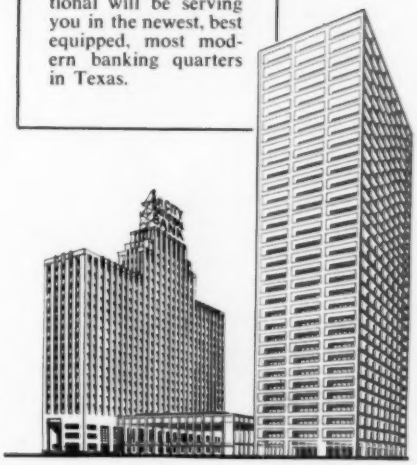
6-8 National Academy of Sciences, National Research Council, ninth national clay conference, Purdue University, Lafayette, Ind.

10-12 American Gas Association, annual convention, Atlantic City.

Saves Time!

When you talk to the men of the First City National Oil and Gas Department about financing you can get to the point fast. These men are thoroughly experienced in production, refining, transportation and marketing – in petrochemicals, too. And because of their daily familiarity with complex financial problems, you can get a quicker decision. When time counts, that's important! Come in to see us.

SOON! First City National will be serving you in the newest, best equipped, most modern banking quarters in Texas.



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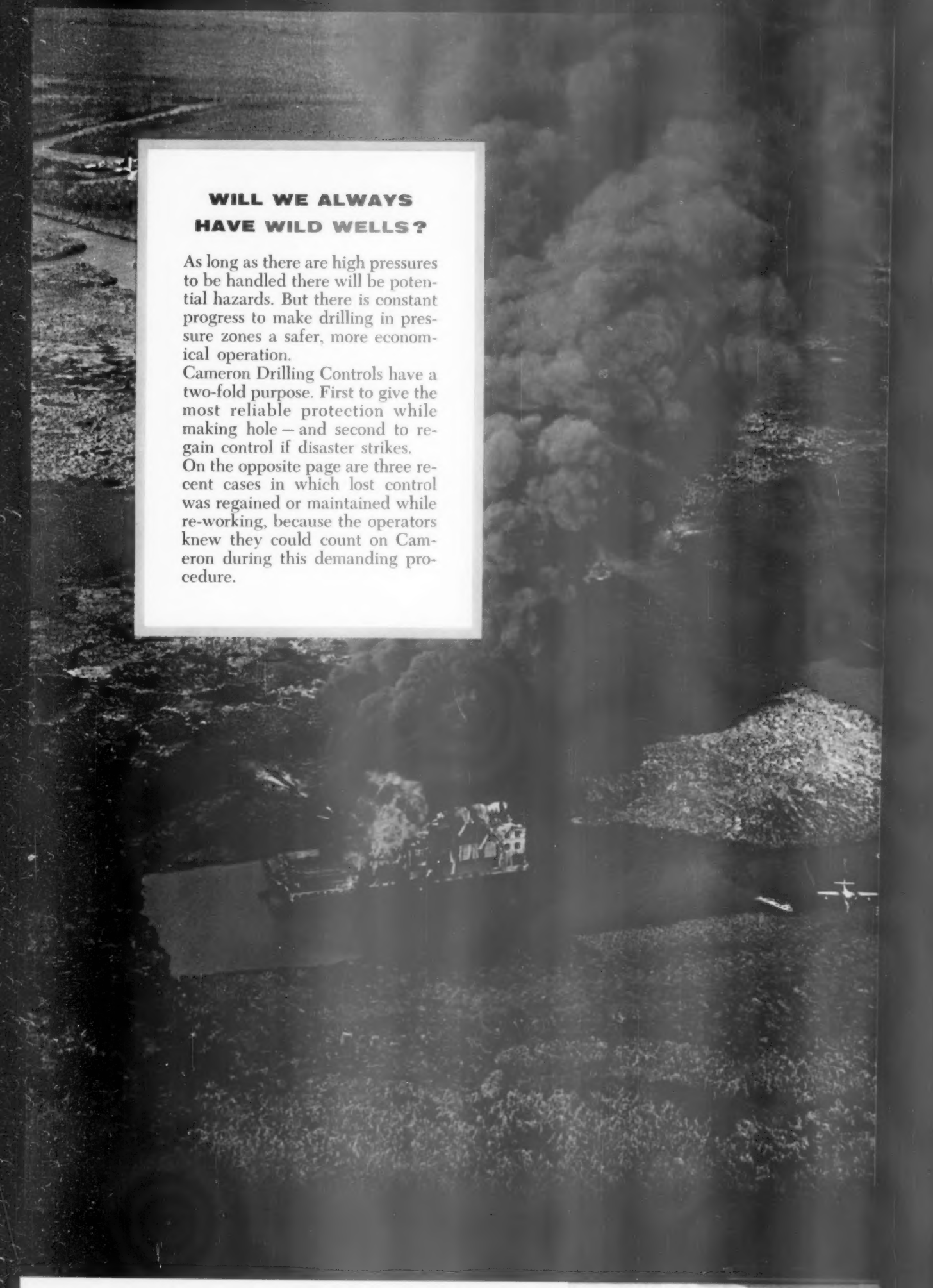


WILL WE ALWAYS HAVE WILD WELLS?

As long as there are high pressures to be handled there will be potential hazards. But there is constant progress to make drilling in pressure zones a safer, more economical operation.

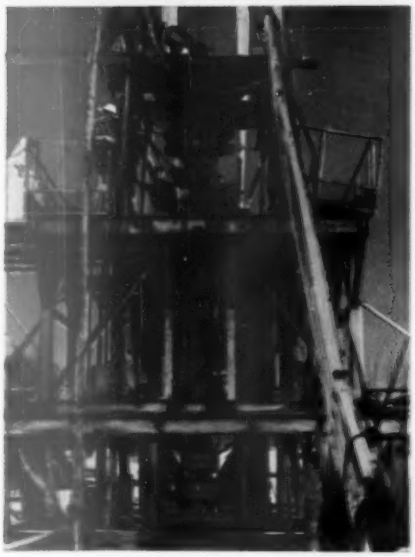
Cameron Drilling Controls have a two-fold purpose. First to give the most reliable protection while making hole – and second to regain control if disaster strikes.

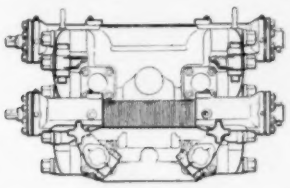
On the opposite page are three recent cases in which lost control was regained or maintained while re-working, because the operators knew they could count on Cameron during this demanding procedure.

Cameron controls safeguarded this tricky re-work operation—sanding was encountered at 13,500 ft. and the production string had to be pulled. A surface pressure of 8,700 psi was safely held in check.

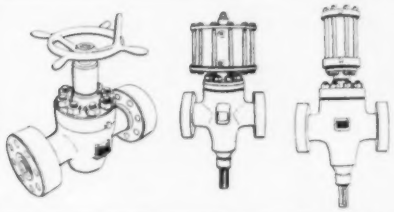
This stack of Cameron preventers helped regain control after a blowout occurred while coming out of the hole.

This well caught fire, after a casing failure, fortunately bridged and extinguished itself—once again under control it required extensive re-work before drilling could continue.

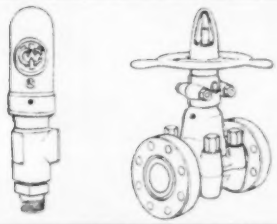




Cameron TYPE "F" BLOWOUT PREVENTERS with balanced pressure design operate easily and give positive protection.



Cameron Type "F" GATE VALVES with manual, air, or hydraulic operation employ the exclusive rotating seat design for extra long wear.



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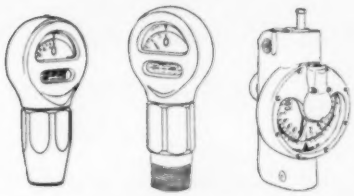

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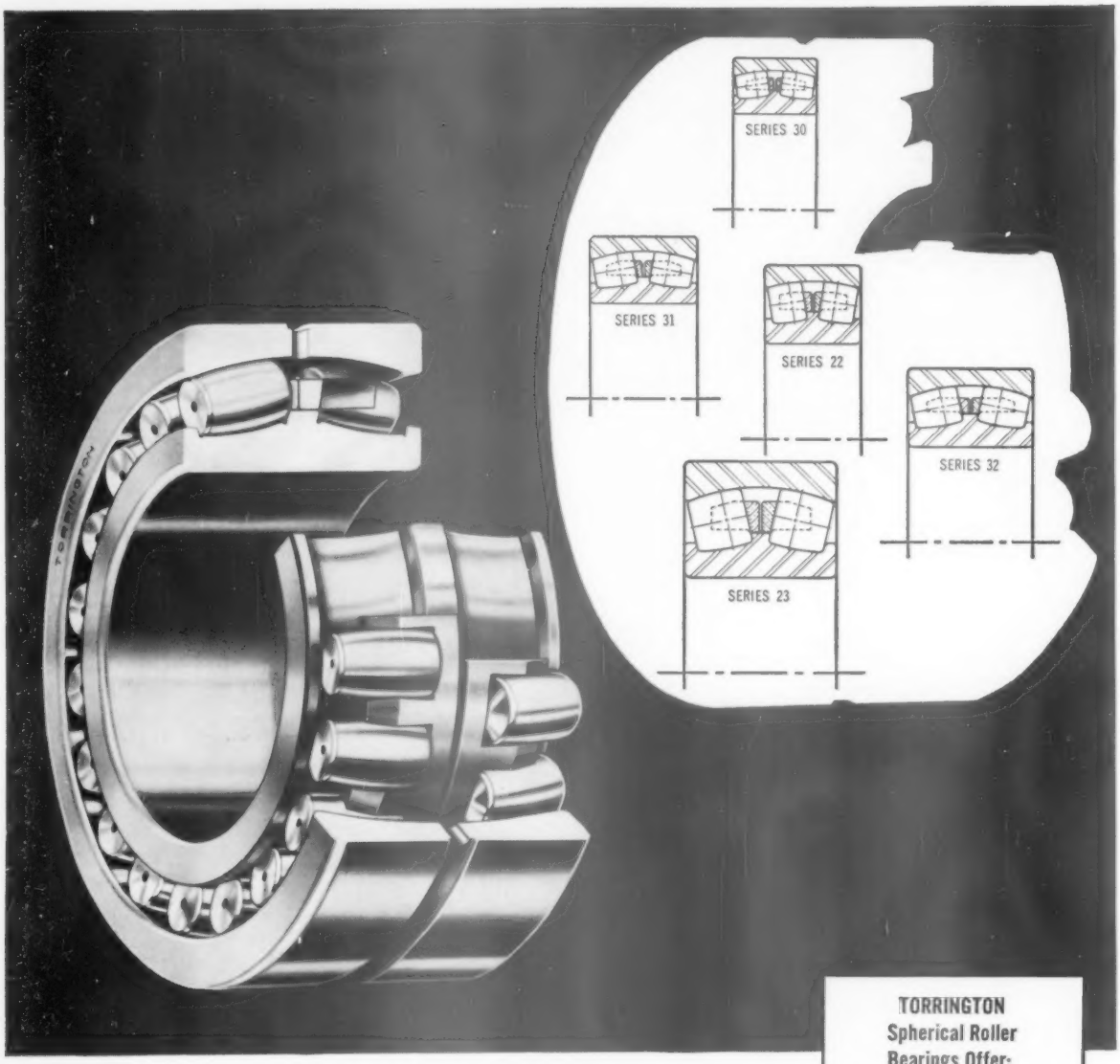

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THE TORRINGTON COMPANY South Bend 21, Indiana • Torrington, Conn.

50 years ago

May 20, 1910

Two months after it blew in out of control, Lakeview Oil Co.'s famous gusher in California's Midway field still is producing more than 40,000 bbl. of oil daily. Already, more than 3,000,000 bbl. of oil has been recovered, making this one of the state's largest wells. Deliveries so far have returned more than $100,000.

Prairie Oil & Gas Co. starts oil shipments through Standard Oil Co.'s newly completed Oklahoma and Arkansas sections of its pipeline from Oklahoma to Baton Rouge. Oklahoma Pipe Line Co., operator on these sections, will deliver the shipments at the Louisiana-Arkansas line to Louisiana Pipe Line Co., operator of the Louisiana section, completed late last year. Oklahoma shipments temporarily are being limited to 6,000 bbl. daily because of the heavy volume of oil being moved through the Louisiana section from the new flush Caddo field.

25 years ago

May 23, 1935

The Texas Co. completes its 1 Bayou St. Dennis wildcat in Jefferson Parish, southeastern Louisiana, as the discovery well of Lafitte field. It is the first commercial production in the parish and deepest on the entire Gulf Coast. The well flowed 2,400 bbl. daily through ⅝-in. choke from sand at 9,556-41 ft., 432 ft. deeper than the Gulf Coast's previous deepest production at Dickinson, in Galveston County, Texas.

Shell Oil Co. and Kettleman-Inglewood Corp. (Standard Oil Co. and Honolulu Oil Corp.) purchased Pacific Western Oil Co.'s undivided one-half interest in 1,760 acres in Kettleman North Dome field, three leases in Inglewood field, and one-half interest in Kettleman North Dome Association's holdings in the former field. In the deal, they assume $10,000,000 worth of Pacific Western notes.

10 years ago

May 25, 1950

Humble Oil & Refining Co. opens Alabama's second oil field with completion of small pumping well in 1 Marion Davies wildcat 37 miles northeast of Mobile, in southern Clark County. The new discovery well (South Carlton field) is productive from Tuscaloosa sand at 5,419-29 ft. The state's only other oil production is Gilbertown field, discovered in 1944 with production from the shallower Selma and Eutaw formations.

Southwest Research Institute chemists at San Antonio launch study of commercial possibilities of handling and storing gasolines and kerosines in pellet form under the new Carburolith process.

JOURNALLY SPEAKING

The Bell and Jack

WHAT WOULD YOU think of a business that's not concerned with profits?

Can you conceive that there could be such in the United States, which pays eternal tribute to the profit motive as the wellspring of progress?

Certainly that wouldn't be the oil business which, according to popular myth, is always rich and profitable.

But it is, according to no less an authority than Jack Rathbone, chairman of the board of the American Petroleum Institute.

Refiners, he says, know how to make everything except money. He suggested that the oil business would be in much better shape if it would make profits a prime product instead of an accidental byproduct.

Maybe that will get nothing but a big laugh from the industry's perennial critics who assume that oil men think about nothing but profits and are past masters at squeezing them out of consumers.

Maybe it will get snorts from oil men themselves who say they are not in business for their health and it's pure poppycock to suggest that they aren't concerned with profits all the time.

But through a strange coincidence, the same week we read Jack's speech at the Detroit meeting of refiners, we receive a booklet entitled "Profit, Performance and Progress" prepared by the Bell telephone system.

Bell studied a cross-section of American businesses and uncovered an amazing condition: A great many companies are not concerned with making a profit.

Oh, they think they are. They say they have to have profits. And they bemoan the lack of them. But they seem to assume that profits will come automatically from just being in business. At least, the Bell study found, they are not doing some things that would seem to be fundamental to any operation conducted with the hope of profit.

The Bell study didn't mention the oil business. But some of its comments on other businesses hit pretty close to home.

Such as these on the profit-poor textile industry: "Competition has been centered primarily on price, with short-run profits as the immediate goal . . . Buyers shop for the lowest price . . . Mills shave fractions of pennies from the price so they can sell more . . . Prices are often cut to the loss level to keep a mill running . . . Chronic excess capacity . . . Overproduction . . . Questionable inventory practices . . . Violent price competition. . . ."

It quotes one textile maker as saying "Capacity operation, with resulting overproduction, entitles none of us to bouquets."

In the business-machine industry, Bell found one company far ahead of the field because of such things as: "It has a profit-planning committee—not a budget committee . . . It watches closely the profit on each item it makes . . . Cost accounting is detailed." But a competitor, now in dire straits, habitually judged performance by sales volume rather than net profit.

In merchandising, Bell found that Sears, Roebuck did not achieve profit through volume, but the other way around. Sears has more than 20,000 profit-and-loss statements a year, requires each department and subdepartment to show a profit, and pays employes on the basis of the profits they produce.

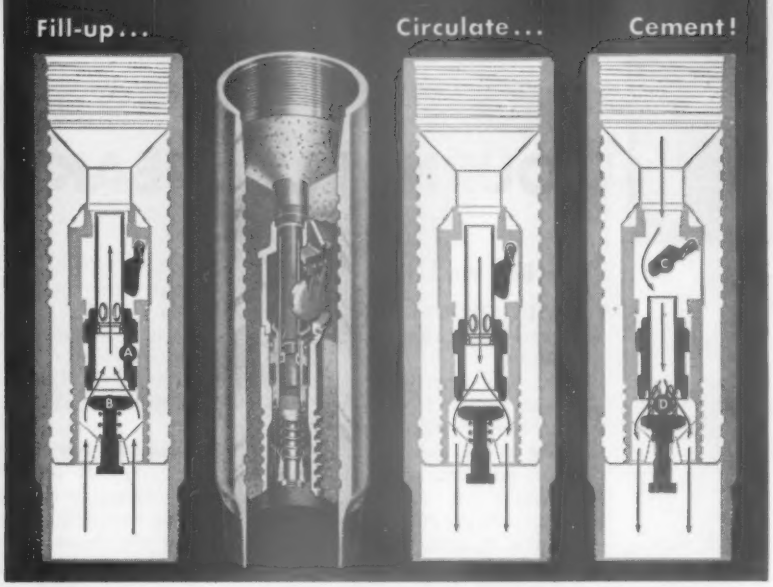
In electrical equipment, Bell found that General Electric is tops because: "As a motive to perform well, profit is powerful at G.E. Detailed cost and profit accounting is used. Profit is the first measure of efficiency. Others are share of the market and sales gain."

Bell studied pairs of successful and unsuccessful competitors. Reasons for the poor standings of some companies included: "Profit is not the first measure of a department's efficiency." "Fear, not profit, has been the prime motivation." "The sales staff was judged by gross sales." "There is no evidence that this company's management has ever tried to build up the profit motive among people in the firm."

Thus the Bell study and Jack Rathbone agree: Profit is essential to a business, but it doesn't come unless management makes it the prime objective.

That sounds too elementary to be worth a second thought, doesn't it? But both Bell and Jack have discovered that in oil and other industries there are companies that don't give it even a first thought.

—Henry D. Ralph.



Ⓐ Valve Sleeve

Ⓑ Valve Seat

Fig. 1 Running in. Variable Valve opens at slightest pressure build-up, and permits unrestricted fluid entry.

Baker Circulating Differential Fill-Up Collar, Product No. 109-E M&F

Fig. 2 Valve open for circulating and hole conditioning.

Ⓒ Flapper Valve

Ⓓ Tripping Ball

Fig. 3 Before cementing, the flapper valve is placed in operation by dropping a tripping ball and applying pump pressure.

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The variable valve in Baker CIRCULATING DIFFERENTIAL shoes and collars is activated *instantly* by the *slightest* increase in differential pressure. Filling is practically as free as though open-end casing were being lowered, thus preventing the build-up of *any* destructive pressure surges. The rate of fill is *always* in complete balance with the rate of lowering and there is no danger of overfill because the differential valve automatically maintains the fill at a level below the fluid level in the well.

You get relief from pressure surges at the *bottom of the string* where pressure build-up occurs. There are no spring-loaded valves to be forced open during the filling operation—no restricted fluid entry through undersized side ports, ineffectively located a joint or two up the string.

Baker CIRCULATING Differential Equipment, with its integral back-pressure valve can be run in tandem, but cannot be used with floating equipment. Circulating Collars can be run with inexpensive Baker Guide Shoes. The CIRCULATING Shoe can be run with or without a Baker Baffle Collar for stopping the cementing plug.

Baker CIRCULATING Differential Shoes and Collars cost no more than Differential Equipment without the "circulating" feature.

Ask for your copy of this brochure which contains facts you should know about Baker DIFFERENTIAL Shoes and Collars; and Supplement No. CS-342-A on the new CIRCULATING Differential Equipment.

BAKER OIL TOOLS, INC. • HOUSTON • LOS ANGELES • NEW YORK

What will you do if the crude price drops?

LONG-HAIRED economists on both sides of the Atlantic are currently engaged in a debate as to whether the world-wide postwar inflationary spiral has come to an end.

Many feel that commodity prices and wage rates are leveling off and that they will remain relatively stable or may even decline over a protracted period of years.

Be that as it may, everyone in the oil business should be alert to what some hard-headed economists and planners in this industry foresee as the future of oil prices.

DEFLATION IN CRUDE OIL during the next 5 years or so is anticipated by a good many major-company economists. They are advising their managements to make long-range plans on this assumption.

They expect the price of crude oil to average around $2.75 per barrel over the next few years.

This doesn't mean that they are planning to cut the price; or that they want it cut; or that they think it shouldn't be higher. They just think that's what it's going to be, and they are being practical about it.

Over-all costs of exploration, drilling, and production are going to come down, in their view, regardless of whether this is achieved happily through general efficiencies or painfully through elimination of weak operators.

They are advising their companies to plan to operate their domestic production departments during the next several years so as to show a profit with crude oil priced somewhat lower than currently.

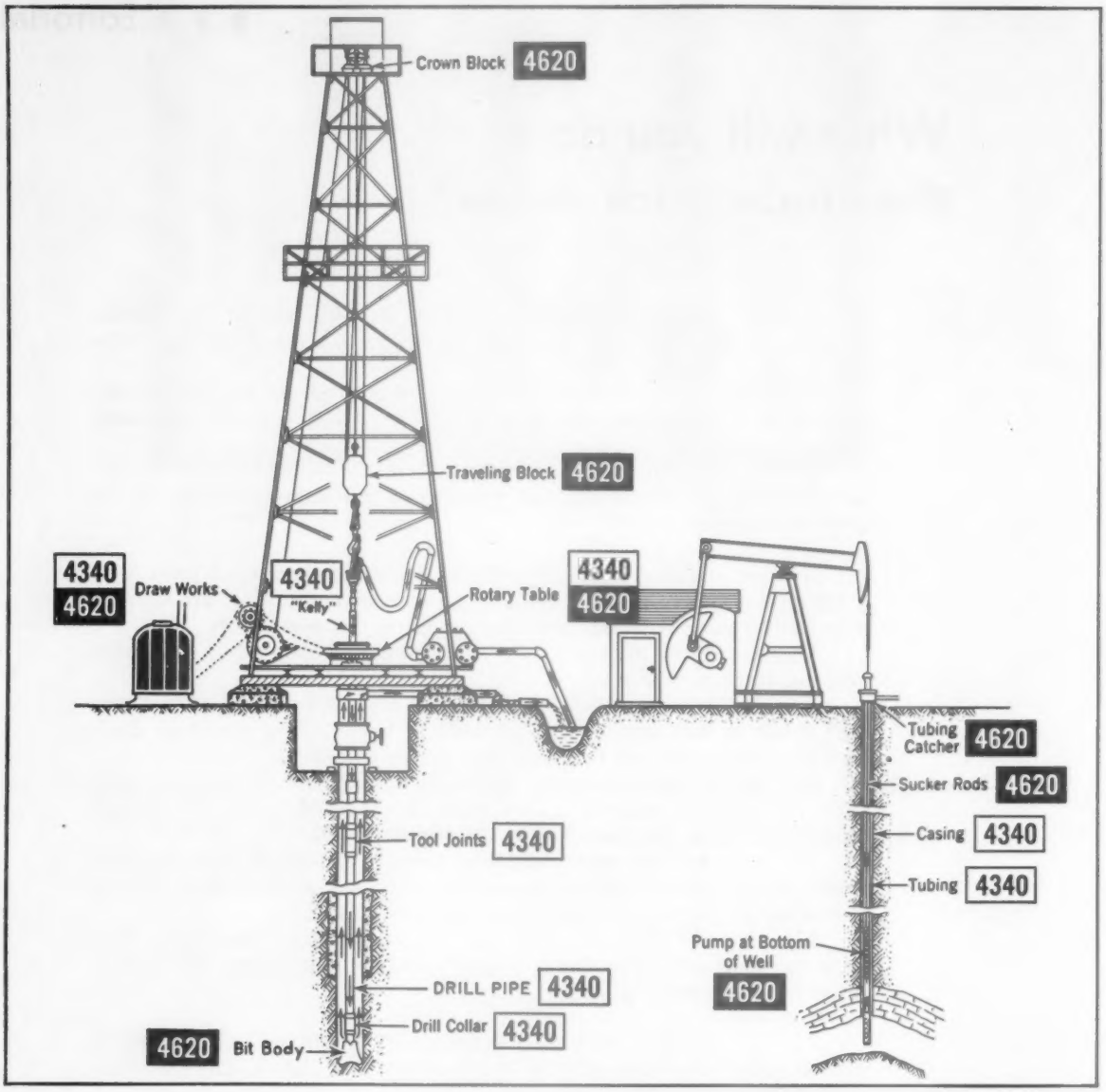
Men who hold this view say they are being realistic, not pessimistic. They could be wrong, of course. But it is significant that a good many major companies are contemplating the prospect.

INDEPENDENT PRODUCERS would be well advised to also base their long-range plans on the possibility of a deflationary trend and a lower price for crude.

Deflation needn't mean disaster. It is possible to make money during a period of falling prices and declining costs, though a little harder than when everything is spiraling upward. It requires different techniques and different attitudes. Also more brains and agility.

Deflation will put a premium on efficiency, prudent investment, and liquidity. Marginal producing operations and shoestring operators and contractors will be squeezed out. But the rugged individualists who survive may constitute a stronger industry by reason of not holding an umbrella over the weakling individualists.

We are not saying that a lower crude price is inevitable. We are just pointing out that some big companies are making plans to stay in business at a profit if that comes about.



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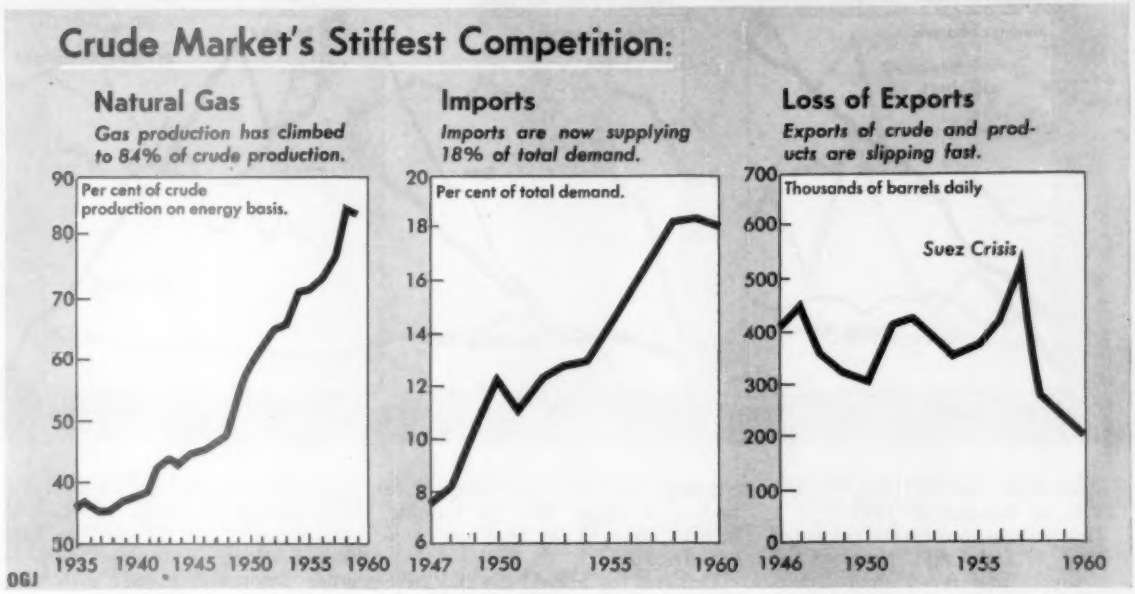


What the Crude Market Is Up Against

• The domestic market has been pinched by inroads of natural gas, rising imports, and falling exports. Imports have been leveling off under government restrictions, but operators still face plenty of competition.

DOMESTIC oil operators almost without exception realize very keenly their crude markets have tightened up in recent years.

They note with disappointment the smaller annual gains in crude production. But few operators realize the sweeping set of economic factors causing this restricted market for domestic crude.

The crude market has been nicked by these developments:

... **Imports** skyrocked after World War II and only recently have been contained.

... **Exports,** on the other hand, dropped almost as sharply and eliminated another market for domestic crude.

... **Natural gas** invaded industrial and residential markets, many of which had been served by products refined from crude.

... **Natural-gas liquids,** a byproduct of gas production, also edged into competition with heating oils, motor fuels, and into the refiner's pantry as a blending or charging stock. In each case this unrestricted and unprorated flow of liquids moved into an area served by crude oil or its products.

... **Total demand for petroleum,** meanwhile, began to slow up in its annual gains, and larger crude markets got harder to come by.

... **Refinery yields** changed to such an extent that the processor needed less crude to make a barrel of product for the new market. With natural gas cutting into demand for distillates and residual, refiners turned more and more to gasoline for their money crop. They converted as much of the crude into gasoline as they could. The result is that less crude is now required to make a given volume of motor fuel.

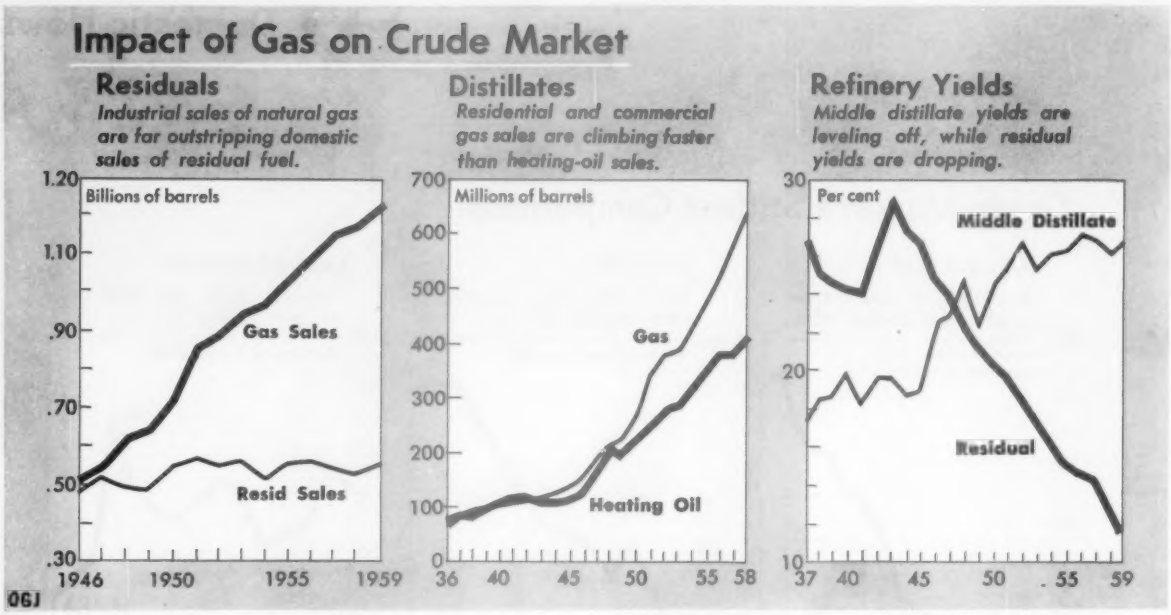
This is the general explanation for a recent Independent Petroleum Association of America forecast that startled many oil operators. The IPAA supply and demand committee estimated that expected total demand for this year can be supplied with practically no increase in crude production. This assumes that crude and product stocks will be held to levels listed as desirable in reports to the Texas Railroad Commission.

In other words, the growth in crude production is stymied in 1960 because refiners can meet their needs with 1959 average production plus using inventories.

Now let's examine individually the economic factors behind this.

Import bugaboo . . . Since World War II, imports have supplied increasingly larger portions of petroleum demand in this country.

The dizzy increase is shown by these statistics: Imports represented only 7.4% of demand in 1957 and only 8.4% in the big year of 1948. but by 1950 they had reached 12.5%. After the Korean War, imports staged



another rapid rise until they reached 18.4% of demand in 1959.

This performance finally convinced federal officials that imported oil was supplanting rather than supplementing domestic production and restrictions were imposed.

The producers still contend that foreign oil is taking too much of the domestic market. But marketers on the East Coast claim hardships under the new program because of restrictions on the imports of heavy fuel.

While the domestic producer lost crude markets to foreign oil in American refineries, he also lost much of his export markets. Crude production in some foreign areas is priced low enough to prevent competition from either U. S. crude or products.

The 13-year trend shows this: In 1947 crude and product exports averaged 451,000 bbl. daily, while the average for 1959 was 240,000 bbl. daily. The decrease between 1948 and 1959 was 128,000 bbl. daily or about equal the production in Colorado last year.

By comparison, the portion of total domestic demand being supplied by imported crude appears to be leveling under government regulation. But the drop in exports hasn't hit bottom yet. The decline since the Suez crisis has been sharp and constant. There is about 225,000 bbl. daily remaining.

Threat from gas . . . Many domestic oil operators also have failed to realize that natural gas has imposed a double threat to their crude markets.

Natural gas itself is taking over fuel markets and natural-gas liquids stripped from the gas stream are finding a bigger role in refining. In both instances the need for crude is restricted.

Demand for natural gas has been growing much faster than oil. At the end of World War II, gas production averaged about 45% of crude production on an energy basis. Gas started its sharp gain just after 1948. This period was highlighted by the construction of long, large-diameter pipelines. They made it possible for natural gas to move into the high-demand areas in the northeast.

Thus, gas production moved from 47.9% of crude production in 1948 to 84% of crude in 1958. In fact, this spectacular growth of natural gas is the explanation for the overall expansion of petroleum in the energy market. Bulk of this market was taken by natural gas and gas liquids rather than crude or products.

Gas liquids actually have taken an important position in the petroleum supply picture in this country. At the end of World War II, gas liquids supplied slightly less than 6% of total demand. Since then there has been a near-constant annual gain in production of gas liquids compared to demand. Over the 1947-60 period gas liquids have supplied an average 8.86% of total demand for all petroleum products.

It's little wonder, with imports rising, exports dropping, natural gas and gas liquids both on the boom, that the oil operator suddenly found his crude market restricted.

Demand growth . . . Since the Korean War two demand trends have appeared affecting the oil operator: The annual percentage increases in total demand for oil and gas have slowed down. Percentage gains in crude production haven't even been that good.

Gains in oil and gas demand, figured on a moving 4-year average, hit a peak of 8.8% in 1951, gradually declining to 3.9% in 1959. Gains in crude production moved from a peak of 6.5% in 1953 to 1% in 1959.

These demand gains look dismal to the crude producer when he looks back to a long period ending in the late 40's when oil demand averaged about 6% gain a year.

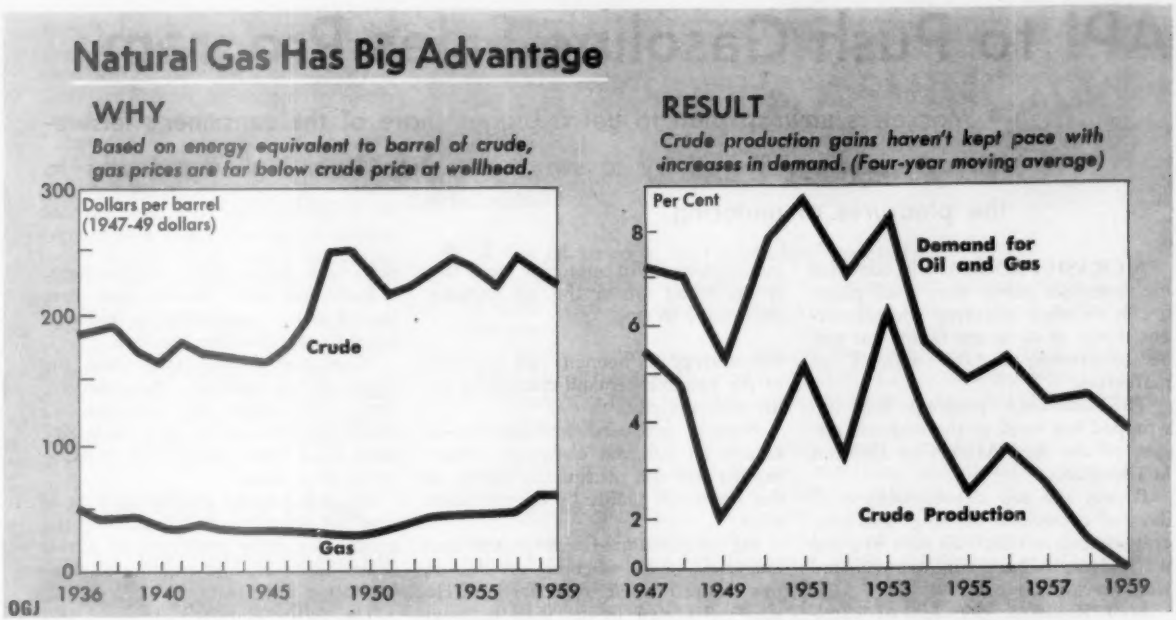
There are several factors in this petroleum demand picture that are changing, and they tend to limit the percentage gains in demand for petroleum products.

The chief fact to keep in mind is that oil and gas use has been expanding faster than total energy consumption in this country. This expansion just can't continue at the past rate. If it did, oil and gas would be supplying all energy requirements by about 1975.

Since oil and gas are not expected to supply the total energy market, they will have to take smaller bits from competitive energy sources in the future.

Figures show the situation clearly: Oil and gas supplied 27.5% of the total energy market in this country in 1927 and 45% in 1938. After declining during the war years, oil and gas portion of the energy market jumped to 72.6% in 1959. The gains will be much slower in the 60's.

In addition to these changes in



overall growth of oil and gas, there have been some upsetting shifts within petroleum demand itself.

Natural gas has cut deeply into markets once served by residual fuel and distillates.

Take residual. At the end of World War II, residual-fuel sales and industrial natural-gas sales were about equal. Both equalled about 500,000,000 bbl. per year on an equivalent energy basis.

Since the end of the war, residual demand has grown very little, totaling only 559,000,000 bbl. for 1959 But industrial sales of gas have climbed to the equivalent of 1,224,000 bbl. of residual. True, heavy fuel lost some of its railroad market to diesel fuel, but its big loss was to natural gas.

Oil also has lost to gas in the potential home-heating market in the postwar period. Distillates sold as heating oil in 1948 amounted to 214,000,000 bbl., while residential and commercial gas sales for that year equalled 217,000,000 bbl. of distillate.

The totals have not even been close since then. The Bureau of Mines reported residential and commercial gas sales for 1958 at 3,586 billion cubic feet, equivalent to 637 million barrels of distillate fuel. But distillate sold as heating oil that year amounted to 413 million barrels. Thus gas has climbed to 1.54 times distillate sales.

These figures easily show that the big expansion in gas sales has been a limiting factor for increased demand for both distillate and residual fuels.

An explanation . . . The basic reason for popularity of gas is price, and again the oil operator is hurt.

Many oil men complain rightfully that gas does not shoulder its proportionate share of exploration and development costs. If it did, gas would be priced higher.

There is no general agreement on how the cost of a well should be split between the gas and oil produced. The just division of cost lies somewhere between the present allocation of cost by the Federal Power Commission and a division based on energy equivalents.

The Bureau of Mines estimates the average price for gas at the well in 1959 was 12.1 cents per M.c.f. Corrected for inflation since 1947-49 and expressed as crude equivalent, this is equal to 57 cents a barrel. Last year's crude averaged $2.94 a barrel, or $2.26 a barrel when corrected for inflation that has occurred since the 1947-49 base period.

This $1.69-a-barrel spread at the well makes it nearly impossible for the refiner to deliver distillate fuel in competition with natural gas in some of the high-demand areas of U. S.

The natural result was a slowdown in demand for distillates. Middle distillate accounted for only 12.6% of total demand for all products in 1932. But by 1952 it had climbed to 22.9% of all demand. In this period, distillate grew much faster than total demand and was an important factor in the rapid growth in demand for the period.

Since 1952, however, middle-distillate demand has ranged between 22 and 23% of total demand. It has just managed to grow in volume with demand, thus showing practically no relative increase.

Changing yields . . . The result of this slowdown in distillate demand is showing up in changed yields the refiner gets from a barrel of crude, and again the producer gets hit.

Take a look at residual first. Yields of residual were at a peak during World War II because of military and shipping demand, reaching 29% of crude runs in 1943. But residual yields began to slip even before the war was over and have kept on going ever since. Residual now accounts for only about 11.8% of crude runs.

Refiners managed to make up part of this loss in residual yield from the average barrel of crude by increased production of distillate fuel.

In 1943, middle distillate yield was 19.8% of the barrel of crude. It reached a high of 27.1% in 1956, and declined to 26.9% last year. As noted previously, middle-distillate demand slowed down in 1952 and the ability of refiners to make up their residual loss with distillate began to fade. In 1952, for example, total yield of middle distillate and residual was 45.3% of the barrel, but by 1959 the total was down to 38.7%.

This decline in yield for the middle distillates and residuals means the refiner is making more of some other product from the typical barrel. It also means that he requires smaller increases in crude to meet demand for these other products.

So any way you figure it, the domestic oil operator has plenty of competition in his crude markets.

API to Push Gasoline-Sales Program

• Marketers unwrap plan to get a bigger share of the consumer's leisure-money spending. They'll try to switch attention from highway deaths to the pleasures of motoring.

A CRASH PROGRAM to convince the American public there's still pleasure in vacation motoring and glamorous things to do in the family car will be undertaken by the nation's oil marketers.

The ambitious program was unwrapped last week at the midyear session of the API Marketing Division in Cleveland.

It was the top development of 3 days of committee meetings and general sessions in which oil men wrestled with ideas to hold old markets and win new ones.

M. J. Rathbone, president of Standard Oil Co. (N. J.) and API chairman, keynoted the general feeling in a convention address. He declared ways to expand demand for oil products constitute the industry's major challenge. He warned the potential payoff here is so great "we should be sure we are not missing any bets."

But even before Rathbone's address, Harry L. Moir of Chicago, Pure Oil Co. marketing executive and chairman of the API committee to stimulate gasoline demand, revealed the plan of attack by his group.

Moir said the committee will be made permanent to oversee a national marketing plan. A director has been employed to plan and direct the program. He is James Bennett, New York advertising man, who has been on the job less than a month.

The program . . . First strategy will be directed at winning for the oil industry a bigger share of America's leisure-dollar spending.

Moir pointed out the oil industry is faring badly—almost by default—in this battle. The American public last year spent $42.9 billion on leisure activities, including $10.6 billion on travel. But of the travel spending, only $2 billion went into automobile expense.

Competing business spent $80 million advertising in this market, Moir said. Americans were told in advertising to ride the airlines, buses, trains, ships; to boat, swim, bowl, golf; to fish, hunt, travel, even to stay at home and enjoy their backyards. Nowhere were they told the pleasure to be gained by motoring.

Moir said, instead, Americans often were bombarded with the dangers and inconveniences of motoring, and this is the trend which the oil industry must unite to stop.

The strategy . . . Bennett won approval of the gasoline demand committee for his two-part plan.

Bennett proposed immediately to launch an editorial campaign featuring the fun and pleasures available to the American family by taking motor trips.

He said national newspapers and magazines will welcome articles of this nature in their travel sections. He also envisioned tie-ins with national radio and television programs sponsored by automotive manufacturers and allied industries.

Companion articles and a campaign on motor safety also will be conducted. These articles will advise motorists of the necessary mechanical checks that should be made before a long trip and tell of other safety rules to be observed.

Other segments of the marketing plan include motoring tie-ins with oil-company advertising, special promotion drives among oil-company employes and stockholders.

The second part of the campaign is still to be organized. It will involve direct advertising for which basic strategy will be made at a meeting of the gasoline-demand committee in Chicago July 12-13.

Bennett said it is time the oil industry and the automotive industry did something to interest the public in motoring. It's time to quit scaring people off the highways. They need to read something besides the grim stories of holiday accident-death tolls, he said.

The stakes . . . Rathbone gave support to the plan in his talk.

He said if every car traveled another 100 miles a year, U. S. consumption of gasoline would rise one per cent.

"This means only 2 or 3 hours of driving each year or less than 4 more minutes a week behind the wheel," he said. "Yet one per cent is a lot of product—about 10 million barrels a year."

Rathbone also called upon the marketing men and the oil industry for imaginative thinking to find brand new uses for various oil products.

Rathbone told them also they should make a real effort to find new ways to merchandise gasoline.

"Everyone is playing around the edges of this problem," he observed, "but what seems like changes are really just more of the same thing. We need some bold, imaginative thinking along these lines."

He also advised courage and business statesmanship in approaching the tough marketing problems of taxes, dealer turnover, and training of service-station attendants.

The Jersey Standard executive said marketers are now up front in the industry's firing line. "The marketer has become the fair-haired boy to which other branches of the business are turning for salvation."

He warned "being the lead horse is never an easy job—even when the road is smooth" and said the welfare and health of the entire industry will depend in large measure on the way marketers do their jobs.

Motor oil . . . Some success has been made in changing a marketing trend which in the last several years saw the ratio of motor-oil sales decline compared with sales of gasoline.

The motor-oil study panel announced that company after company reported improvements in its motor oil-gasoline ratio since the group launched its campaign 2 years ago.

The committee reported the trend is now away from 4,000 or 5,000 mile oil-change recommendations to ones nearer the API-recommended 2,000-mile interval.

Dealer retirement . . . A new plan to provide retirement benefits for service-station operators was revealed to members of the service station advisory committee.

The plan was pictured as one way of correcting the problem of dealer turnovers that is plaguing many companies.

Any operator less than 65 years old who has been a dealer at least 3 years and is a member of API will be eligible. Only 250 participants are needed to get the program started, and it will be administered by the API.

The dealer may participate at the rate of $16 per month up to $200 per

month. The sum can be changed each year at the dealer's option. Annuities then will be purchased on the life of each participant as issued by a selected life insurance company.

Savings at present of 5 to 10% over purchasing annuities in the open market may be achieved, the committee was told. This saving may be increased if a larger number of dealers join the plan or if insurance companies become competitive for the business.

Other benefits under the program include a disability benefit, death benefit, loan benefit, paid-up retirement benefit, and a withdrawal benefit. Thus the dealer will be given as complete protection as possible.

Kenai Gas to Flow

. . . into Anchorage for use in local markets.

ANCHORAGE, Alaska, citizens will have natural-gas service from the Kenai field by November this year.

Pipe for the 90-mile transmission line is en route from Scotland, and pipe for the distribution system in Anchorage is en route from Japan. Construction will start about July 1 and be completed by the end of October—in time to provide service for the winter season.

Anchorage Natural Gas Corp., which holds the Anchorage gas franchise, said last week in Houston it will route the line across Turnagain Arm of Cook Inlet rather than run the longer distance around it (OGJ, Oct. 26, 1959, p. 55). The exact location of the crossing will be announced later.

The company will tap three Kenai peninsula wells drilled by Union Oil Co. of California and Ohio Oil Co., which made the gas discovery last year about 30 miles south of Richfield Oil Corp.'s big 1957 oil discovery.

The 12¾-in. transmission line will have a capacity of 71 million cubic feet daily, without compression.

Anchorage Natural Gas still does not know the size of its initial market, Robert B. Baldwin, Houston, president, said last week. Residents and businesses in Anchorage and two suburbs, Spenard and Fairview, will have to convert their present fuel systems to gas.

Separate construction contracts will be let shortly on the transmission and distribution systems. Delta Engineering Corp. is handling engineering and coordinating the project. The transmission line will cost an estimated $12 million and the distribution system $4 million.

watching WASHINGTON

Clyde La Motte

• A lot of smoke, but not very much fire . . .

IT APPEARS reasonably safe to assume that nothing much is going to come from the congressional probe into Federal Power Commission operations.

Up to this point—midway through the second week of hearings by the House Legislative Oversight subcommittee—no evidence has been presented to indicate that there has been anything seriously amiss in industry-commission relations.

The "prosecution"—the committee's staff counsel—has shown no indication of setting the stage for any surprising and damaging revelations. Instead, it seems to be chiefly a fishing expedition.

Although there have been some needling questions asked and some staid remarks made by a few members of the committee, no one has called for the scalp of FPC Chairman Jerome Kuykendall or of any other commission members.

The chief net result, in the long run, may be to add some momentum to legislation which would clarify rules of procedure for all regulatory agencies. Such a clarification would give both industry and agency officials a better understanding of what type of contacts are permissible and how they are to be conducted.

• Jobbers bask in unaccustomed spotlight . . .

OIL JOBBERS are encouraged by the fact that marketing is getting a great deal more attention from the industry as a whole these days.

This was evident at the midyear meeting of the National Oil Jobbers Council in Washington last week.

The jobbers are pleased, naturally, by such a trend. There have been times in the past when they felt that marketing was the neglected segment of the industry.

E. K. Bennett, president of the NOJC, remarked on this increasing awareness of the importance of marketing.

"A tremendous change is taking place within the industry today," he said. "Everybody is taking a new and fresh look at marketing and I believe that we, as marketers and independent jobbers, are on the threshold of a new era in marketing of petroleum products."

Bennett noted that "almost everybody who produces crude oil today has suddenly realized that the barrel of crude which he produces does not really represent a profit until all of the derivatives have been sold and delivered." Therefore, he concluded, "they are much more conscious of the problems entailed in the marketing of these products."

• Coal ranges far afield in seeking support . . .

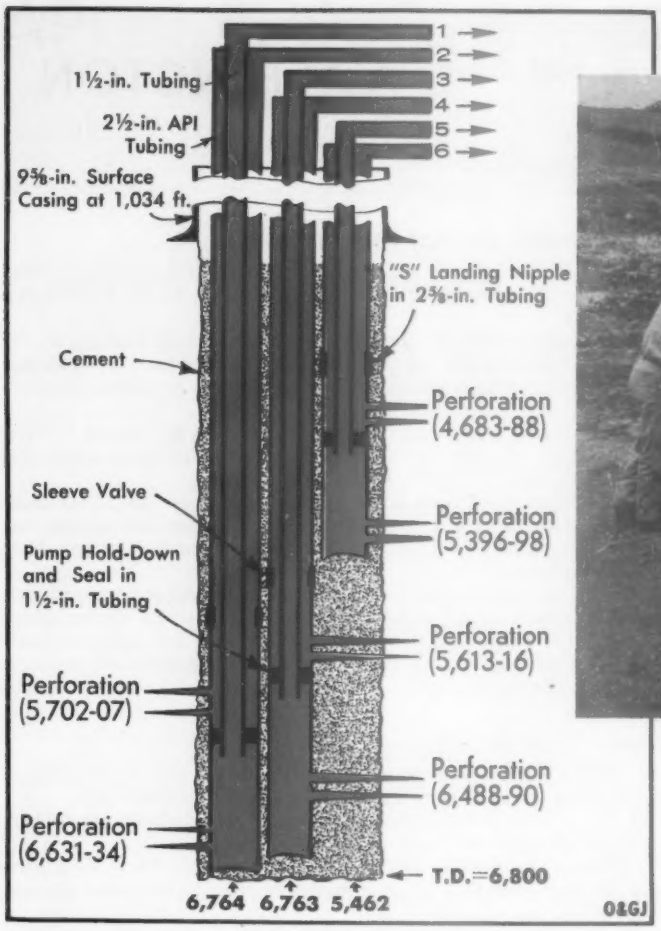
THE COAL industry doesn't seem to be overlooking any opportunity to plug for a fuels study by a congressional committee. For instance, at a recent meeting of the executive advisory committee of the American Legion, a member of the National Coal Policy Conference succeeded in getting the committee to adopt a resolution approving a fuels policy. Thus, this resolution will be presented at the Legion's annual convention.

• Interior hopes to avoid a new resid hike . . .

THERE ISN'T likely to be another increase in residual fuel oil import quotas during the current allocation period.

Some importers have warned that shortages are likely unless there is a hike, but the present intent of the Oil Import Administration is to leave the quotas as they are.

However, if stocks are drained appreciably, it is possible that quotas for the 3-month period beginning July 1 may be slightly higher than normal to permit stock rebuilding.



Sunray's Sextuple Well

TUNEY BURGER, drilling foreman for Sunray Mid-Continent Oil Co. at Victoria, Tex., checks out the wellhead equipment on the industry's first sextuple completion.

Sextuple Completion Slashes Costs

● Sunray Mid-Continent comes up with an industry first in its 6 J. A. Graves in South Texas. The sextuple, which looks like a real money saver, actually is three slim-hole dual completions in one well.

Ed McGhee
Drilling Editor

THE OIL world this week is wondering how to describe exactly what Sunray Mid-Continent Oil Co. has done in its 6 Graves in Jackson County, Texas.

There's no ready name to call this unique completion, but this much is certain:

... It's the world's first well producing from six separate completions.

... It contains no long string of casing.

... It does contain three strings of 2½-in. API tubing (2⅞-in. o.d.) cemented side by side in the open hole. Inside each of the 2½-in. strings is another string of 1½-in. tubing.

... Two sands are perforated in each 2½-in. string. One sand flows out the 1½-in. and the other out the annulus between 1½-in. and 2½-in.

... Except for the christmas tree, every piece of equipment in the well is an off-the-shelf item proved reliable by long use in the oil fields.

Most remarkable, Sunray made this six-zone completion at a cost little more than most companies are accustomed to paying for a conventional single completion with 5½-in. casing and 2½-in. tubing on packer.

The entire operation went so smoothly that you can only wonder why no one had done it before.

Sunray's sextuple completion came within a month of the industry's first quintuple completion, which was made by Sinclair Oil & Gas Co. off Louisiana (OGJ, Apr. 18, p. 77).

•

Multiple, multiple . . . Obviously, the 6 Graves is a sextuple completion. Beyond that, there's no common oilfield description for the method used to complete the well.

Recently, Sunray and others have made "multiple tubingless completions" where two or three strings of 2½-in. tubing are cemented side by side. But, in these past completions, only one zone produced out of each

string of 2½-in. Does this make the 6 Graves a "multiple, multiple tubingless completion"? Not quite. The 1½-in. strings are tubing.

When you take each 2½-in. string by itself, it fits all the patterns for a tubing-annulus dual completion. The small diameter of the pipe makes them slim-hole completions.

Thus, Sunray has made three parallel slim-hole dual completions in one well. No one has ever needed a name for such a well before; there's never been one before.

Smooth and fast . . . Sunray has only 11 days of rig time invested in the 6 Graves. The well was spudded April 16 by Hunt Drilling Co. On April 27, the cement plugs were pumped down and the rig released. All subsequent work was done by wire line or by a light pulling unit.

The 6 Graves is a field location inside North Laward field. A great number of thin Frio sand stringers produce in the area. Sunray expected as many as 11 of these marginal reservoirs when drilling began. There appeared to be some drainage from under Sunray's lease by offset operators, so the company wanted to produce as many of the zones as practical. Still, production from most of the zones is so small that cost had to be held quite low.

These facts led Sunray to make the sextuple in its unprecedented fashion.

Setting two or three strings of 2½-in. in parallel is quite common in the area. In fact, the Hunt Drilling rig had made almost a dozen such completions in sequence before spudding the 6 Graves. However, so far as is known, none before produced more than one sand out of the 2½-in. pipe.

The 6 Graves contains only 1,034 ft. of surface pipe. This is a 9⅝-in. string set in 12¼-in. hole and cemented to the surface. The remainder of the hole is 8¾-in. and it reached total depth of 6,800 ft. only 9 days after spudding.

At total depth, the three strings of 2½-in. pipe were picked up and run, one by one. This is API upset J-55 tubing. The first two strings were run almost to bottom. The No. 3 string was run only to 5,462 ft. Each of the strings contained an Otis Type-S landing nipple at a strategic spot.

Good cement job . . . With all the pipe in the hole, the strings were landed in their hangers and the wellhead flanged up. Then, the well was cemented by pumping down both long strings of 2½-in. The short string had been bull-plugged, but both long strings carried guide shoes and latch collars. The cement "follower" plugs seated in these latch collars.

All three strings were fitted with hard-rubber "centralizers." These insured a good cement sheath between the pipe and the walls of the hole as well as between the individual strings themselves. There were, however, no scratchers on any of the strings and neither rotation nor reciprocation of the strings was attempted during cementing.

Some 1,180 sacks of 12% gel cement was pumped into the well. Approximately 78 sacks of this circulated back to the surface. From all indications, the cement job was good. The final cement reaching the surface appeared relatively uncontaminated and no appreciable quantity of mud came to surface in later production tests. Packer-leakage tests have disclosed no communication between any of the zones.

Sunray personnel give much of the credit for the good cement job to the mud program. Below 4,000 ft., a gyp mud was used and it appeared to keep the hole in good condition with neither appreciable washing out of the hole nor build up of wall cake.

The cement was displaced with salt water. The salt water not only is a better perforating fluid than mud but also makes it easier for the well to start flowing.

As soon as the cement plugs bumped bottom, the rig was released.

Self-aiming guns . . . After the rig moved off 6 Graves, the well remained closed in several days while cement set and Sunray engineers studied the logs to determine which zones they wanted to produce from which strings. Regular electric log had been run in the 8¾-in. hole before cementing and neutron and collar-locator logs afterward.

Each of the 2½-in. strings was perforated in two zones. In all six zones, the perforating jets had to be directed away from parallel strings. This was done with a combination single-direction perforating gun and direction finder. The guns fire two shots per foot with a maximum of 15° difference in shot direction.

The direction finder reads at the surface. It is a metal-sensing device which shows whether the perforator is pointed toward or away from parallel strings. Each time the perforating line is raised a few feet, the direction finder rotates 30°. Thus, a few strokes up and down of the perforating line shows when the gun is pointed in the right direction.

Tubing into landing nipples . . . With the well perforated, a contract well-pulling unit ran the 1½-in. strings into 6 Graves. On the end of each string was a pump-hold-down device designed to seat in the Type S landing nipples already in the 2½-in. strings. The hold-downs also carry packing to seal the end of the 1½-in. in the 2½-in. In effect, the hold-downs are packers.

Where the 1½-in. tubing was to lay in front of perforations, special "blast nipples" were used. These are heavy-wall, extra-hard steel joints which resist erosion caused by flow from the perforations.

Below these blast nipples, the strings were actually 1¼-in. instead of 1½-in. Both 1½-in. and 1¼-in. are integral-joint nonupset pipe. With these strings in place, the well was ready to be put on production.

A sleeve valve had been run in each of the 2½-in. strings immediately above the Type S landing nipple. These valves aided in unloading the well. First, one of the better-looking zones was swabbed lightly. It came in readily and was soon flowing strongly. Gas from this zone was put into the other zones in turn. With the sleeve valve open, the salt water in the strings could be circulated out. Thus, all five remaining zones were brought in with no swabbing. This process was not only cheaper than swabbing, it was also less dangerous since broken swab lines have caused loss of many wells.

All gas, no pumping . . . All six zones in the 6 Graves produce dry gas.

Sunray will never be troubled with artificial lift of this well. Moreover, there is little corrosion of down-hole equipment in the field. For these reasons, Sunray expects to be able to operate its 6 Graves at low cost and sees little reason for the small hole diameters to ever become a problem.

Two of the zones do produce some water, and Sunray perforated both these zones in the same 2½-in. string. Thus, if either or both zones cease flowing, little will be lost in pulling the 1½-in. string and recompleting.

Sunray engineers say there would be little unusual difficulty in plugging back and recompleting inside one of the 2½-in. strings. Concentric-tubing or wire-line tools could be used.

Here is how the zones tested:

. . . No. 1 tubing zone at 6,631-34 ft. produced 750 M.c.f. daily at 2,410 psi. through ⅛-in. choke. This zone is producing through one of the long strings.

. . . No. 1 casing zone at 5,702-07 ft. produced 300 M.c.f. daily at 700 psi. through 9/64-in. choke.

. . . No. 2 tubing zone at 6,488-90 ft. produced 400 M.c.f. daily and 1½ bbl. of water at 1,025 psi. through

9/64-in. choke. This zone produces from the second long string.

... No. 2 casing zone at 5,613-16 ft. produced 220 M.c.f. daily and 2 bbl. of water at 695 psi. through ⅛-in. choke.

... No. 3 tubing zone at 5,396-98 ft. made 600 M.c.f. daily at 1,900 psi. through ⅛-in. choke.

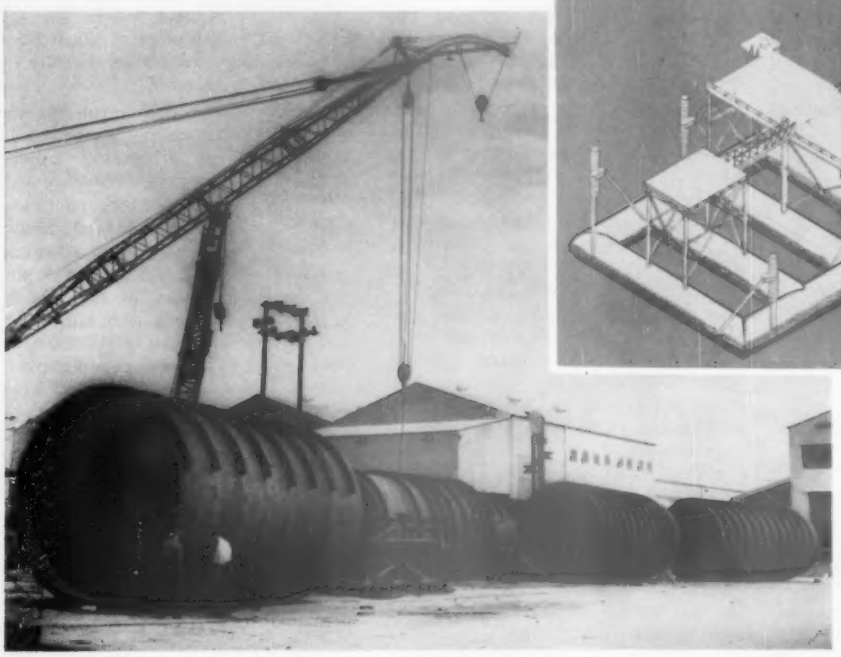
... No. 3 casing zone at 4,683-88 ft. made 500 M.c.f. daily at 1,900 psi. on ⅛-in. choke.

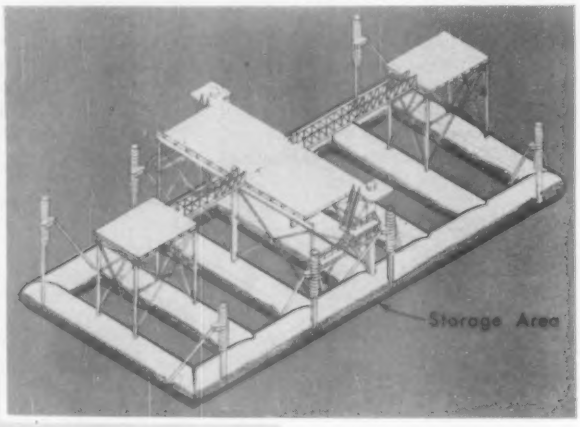
Usual methods wouldn't pay . . . In fields like North Laward which have thin zones tending to shale out from one location to the next, you can't be sure your well will pay out until you've got all your money back. And, when Sunray evaluated its 6 Graves location, it based its appraisal on productivity of nearby locations. On this basis, Sunray couldn't expect a payout by usual completion methods.

For instance, three conventional duals (with 5½-in. casing and 2-in. tubing) would return only 75 cents per dollar invested.

Two conventional triples (5½-in. casing producing through two 2-in. tubing strings and the annulus) might not pay back the investment required.

Two tubingless triples (three parallel 2½-in. strings each producing one zone) would be attractive but would cost almost 50% more than the method finally adopted.





GIANT-SIZED steel pipe will be used to build the base of a new-type offshore crude-storage platform.

Offshore Crude Will Be Stored Under Water

• A submersible oil storage facility now being built is portable and cheaper than comparable topside units.

THE INDUSTRY'S first under water oil storage facility—a movable barge-type installation complete with separation equipment—is being built at New Orleans. It will go to work off Louisiana this summer.

The specially designed facility will have a capacity of 15,000-plus barrels of crude, although this amount may be increased later if salt water ballast is released.

Ocean Drilling & Exploration Co. is the owner-designer and Higgins, Inc., the builder. The facility will cost about $400,000, compared with more than $1 million for comparable storage above water.

Crude will be stored in huge cylindrical tanks which rest on the ocean bottom. The tanks are arranged in a rectangle, 209 ft. by 88 ft.

Mounted on the tanks will be three platforms standing 45 ft. above the ocean bottom and 15 ft. above the water surface.

In addition to the crude storage tanks around the perimeter of the rectangle will be five cross-section tanks for use both as crude storage and salt-water ballast. The ballast will provide negative buoyancy when no oil is stored.

If the facility is moved, all the tanks will be emptied to permit it to float to a new location. It can be readied for a move in a day's time.

ODECO's chief engineer, Tom Graham, said the same type of facility could be adapted for use in waters as much as 100 ft. deep, although it would be more expensive. The one now under construction is for use in 30 ft. of water.

Graham said he considers the facility as useful principally during an interim period when operators are checking the reserves of a field and deciding whether it is large enough to warrant construction of pipelines.

ODECO will place the facility in its Block 90 operation in Eugene Island area, developed jointly by ODECO and Midwest Oil Corp.

ODECO also has provided means for cleaning the tanks—a major problem for subsurface storage. Some of the tanks will be designated "bad oil" tanks, and these will be used for basic sediments and water suctioned off from the storage tanks. The bad oil tanks will be pumped out into a barge.

The Latest Look at Stripper-Well Production

State	No. of Stripper Wells	Production in 1958 (bbl.)	Abandonments	Average Daily Prod.	Prod. Acres	Reserves (Thousands of bbl.) Primary*	Secondary	Total 1-1-59
Arkansas	4,258	8,066,389	137	5.19	61,195	41,032	44,980	86,012
California	20,718	61,913,322	197	8.19	135,440	62,774	475,115	537,889
Colorado	314	950,762	4	8.30	13,140	10,784	.....	10,784
Illinois	28,137	79,778,200	645	7.77	556,625	417,097	.....	417,097
Indiana	4,349	8,429,620	90	5.31	63,460	46,135	39,500	85,635
Kansas	32,555	50,679,891	981	4.27	792,242	371,770	85,550	457,320
Kentucky	13,388	13,446,000	185	2.75	72,000	50,000	55,000	105,000
Louisiana	2,792	12,424,316	182	12.19	203,630	98,810	69,800	168,610
Michigan	3,607	9,296,834	170	7.06	156,200	61,362	102,703	164,065
Mississippi	223	907,138	28	11.14	8,930	7,210	.....	7,210
Missouri	133	83,015	4	1.71	2,390	650	.....	650
Montana	3,106	4,012,853	1	3.54	106,820	36,480	107,275	143,755
Nebraska	48	137,845	17	7.87	4,340	924	1,750	2,674
New Mexico	4,340	5,859,549	10	3.70	98,640	49,940	37,750	87,690
New York	16,000	1,700,000	1,500	0.29	100,000	79,000	53,000	132,000
North Dakota	69	368,000	2	1.46	743,250	551	5,410	5,961
Ohio	17,073	6,525,000	617	1.05	150,000	67,641	5,500	73,141
Oklahoma	62,905	86,273,000	476	3.76	1,012,363	659,535	724,130	1,383,665
Pennsylvania	66,054	6,485,466	2,293	0.27	625,732	120,018	†386,007	506,025
Tennessee	34	6,504	.....	0.52	170	.....	.....	.....
Texas	77,920	145,501,886	2,094	5.12	1,722,968	1,139,675	966,045	2,105,720
N. Texas	26,929	40,993,796	335	4.17	371,945	325,480	373,050	698,530
W. C. Texas	11,000	14,715,170	742	3.67	293,700	105,835	103,900	209,735
Other	39,991	89,792,920	1,017	6.15	1,057,323	708,360	489,095	1,197,455
Utah	13	11,406	1	2.40	300	.....	.....	.....
Virginia	13	4,450	.....	0.94	100	.....	.....	.....
West Virginia	12,808	2,186,500	83	0.47	208,930	37,458	50,000	87,458
Wyoming	3,013	6,794,189	71	6.18	83,858	75,279	235,500	310,779
Others‡	.....	.....	.....	.....	.....	160	.....	160
TOTALS	373,870	511,842,135	9,788	3.75	8,645,691	3,434,285	3,445,015	6,879,300

*Secondary reserves of projects now in operation included with primary reserves. †Estimated probable secondary recovery reserves. ‡Primary reserves of stripper wells of Tennessee, Utah, and Virginia.

Stripper Output Is Up 7.8%, Reserves Dip

- Most recent survey shows 65% of all U. S. wells are in the stripper class. Production from these wells totals 21% of the nation's production.

STRIPPER-WELL production in the United States jumped 7.8% in 1958 over 1957, with a total output of 511,842,135 bbl. from 373,870 wells in 25 states.

This was 36,923,114 bbl. more than output the previous year.

Although Texas paced the field with stripper production of 145,501,886 bbl., up 42% from 1957, this largely was a book increase and resulted from a more complete method of collecting data, according to Albert E. Sweeney Jr., Oklahoma City, director of technical services of the Interstate Oil Compact Commission.

There were 1,351 more stripper wells shown on the survey in 1958 than the year before. Pennsylvania, long the leader in number of wells making 10 bbl. or under, reported 2,293 compared to 1,795 in 1957. Texas is pushing Pennsylvania for well totals, boosting its own figures from 1,403 to 2,094 in 1958.

Average production per well was the best in several years at 3.75 bbl. per day. This compares with 3.50 bbl. in 1957, 3.59 bbl. in 1956, and 3.58 bbl. in 1955. The number of abandonments was greater, however, totaling 9,788 in 1958 against 8,651 the previous 12 months.

Signal to Rebuild

THE fire-ravaged Hancock refinery at Signal Hill, Calif., will be put back in operation by Signal Oil & Gas Co.

Signal said last week it hopes to be processing 15,000 to 20,000 bbl. daily before the year is out. When the rebuilding job is finished, capacity will be 50,000 bbl. daily. The refinery was almost destroyed 2 years ago.

Wyoming showed a big jump in stripper output, moving from 2,954,176 bbl. in 1957 to 6,794,189. This was accounted for largely because the per well production in the state soared from 3.22 bbl. to 6.18 bbl.

Total reserves dipped to 6,879,300,000 bbl. from 8,088,635,000 bbl. in 1957. The primary reserves were set at 3,434,285,000 bbl. and secondary reserves at 3,445,015,000 bbl.

These stripper reserves represent 11.2% of the total U. S. oil reserves. Productive acreage registered an increase from 5,720,650 to 8,645,691 with several states contributing notably to the higher totals.

The fifteenth annual stripper survey is a joint effort of the IOCC, the National Stripper Well Association, and the Independent Petroleum Association of America.

The survey report said that 65% of all wells in the U. S. come in the stripper class, making 10 bbl. or less a day.

1 Many weight-saving ideas were built into a new rig.

2 Aluminum substructure weighs about 30,000 lb., 60% less than the equivalent in steel. Draw works supports are cantilevered.

4 Two kinds of mud tanks are used. One is rubberized with aluminum frame. The other (background) is fully aluminum.

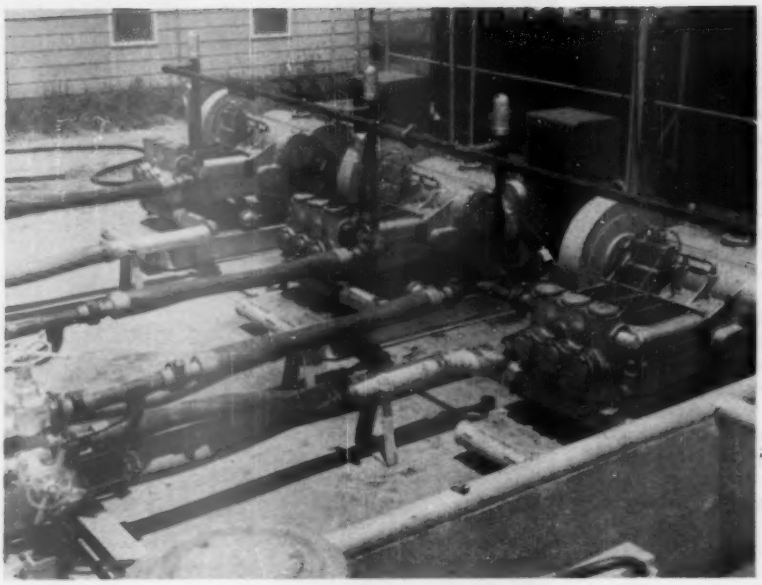
New Rig Weighs in Light, But Packs

A BOLIVIA-BOUND drilling rig that will be airlifted in chunks of 4,000 lb. is ready for shipment from Houston to the west coast of South America (OGJ, Newsletter, May 9).

The rig will be used in the joint exploration program of Bolivia California Petroleum Co., a subsidiary of Standard Oil Co. of California and Cia. Petrolera Boliviana Shell, Ltd., one of the Royal Dutch-Shell companies.

Designed to reduce weight but retain efficiency, the rig was built from basic specifications prepared by Standard of California in consultation with engineers of Asiatic Petroleum Corp., another Royal Dutch company.

The rig was assembled at Joe Stine, Inc., Houston fabricating yard, and will be shipped to Antofagasta, Chile, moved by train to Cochabamba, Bolivia, trucked further into the interior, and finally airlifted by C-82 planes about 100 miles to the drillsite. Loffland Brothers Co., the drilling contractor, hopes to be on location 65 days after the rig leaves Houston late this month. Aluminum furnished by Reynolds Metal plays an important



3 Triplex-plunger pumps—light weight and electrically driven—are used exclusively as rig pumps for the first time.

5 Single-drum draw works is light weight, electrically driven, and dismountable. It has no shifting transmission.

a Big Punch

role in cutting weight. Eleven Cummins diesel engines will generate current for the reliance electric generators. Wagner Morehouse designed the electric-driven draw works. Ideco provided the 132-ft. mast and the aluminum subbase. The mast has special alloy steel legs with a rating of 350,000 lb. hook load with concurrent pipe setback load of 150,000 lb. Gardner Denver's triplex-plunger pumps will be used.

The rig weighs less than 400,000 lb., not counting drill pipe, supplies, and campsite equipment. It will cost about $1,250,000.

Standard of California, the operator, believes the investment has a good chance of paying off because it makes possible the drilling of prime prospects which otherwise would be inaccessible except by construction of high-cost roads into central Bolivia.

Corcoran Claims Nothing "Secret" About His Talks

THOMAS G. CORCORAN last week had his "day" before the House committee that is making a probe of the Federal Power Commission and its handling of the Midwestern case.

Corcoran strongly defended his own and his company's action.

He said there was nothing "secret" or wrong about the conversations he had with three members of the commission shortly before the commission issued its ruling.

He said he did not go into the merits of the case in these conversations but that he or any other company representative had a perfect right to do so.

Corcoran pointed out that the staff of the FPC has full ex parte access to the commissioners in initial license cases and that it can take a position against the applicant. In turn, therefore, a company has an equal right to make ex parte presentations, Corcoran insisted.

"An applicant has the same right to talk to the commission as a staff member does," he said.

He said his principal reason in talking to the commissioners was to try to insure commission action before the October 31 deadline Midwestern was facing in its contracts with its suppliers.

"The Canadian contract would not have been reinstated after default of the October 31 deadline without a rise in the price of gas," he said. "And each rise of 1 cent per thousand cubic feet would have cost consumers receiving Midwestern's gas an additional $744,000 per year.

Corcoran said that to avoid a possible commission deadlock on the issue of rate of return, he had called attention of the three commissioners to an "open end" procedure they could follow which would enable them to make a final decision on that question at a later date.

He noted that neither the law nor FPC procedures require a rate determination in a certificate proceeding.

Wants more speed . . . Corcoran also took advantage of the opportunity to voice some of his views about the backlog of cases at the commission and the long delays pipeline companies and producers face in getting FPC action.

"In our case, we had been trying for 4 years to build this pipeline, and that's far too long for a company to be forced to wait," he said.

About this interview . . .

Low allowables and stretched-out well payouts have driven much of the once-plentiful promotion money out of the oil-drilling and production business. In most quarters, this is felt to be a temporary situation. Nevertheless, the current era of "tight money" is proving quite painful in many instances to small producers and drilling contractors who in the past have relied heavily on such financing. Banks and supply firms still are heavily engaged in oil financing. But a small operator finds that there are times when neither is prepared to lend money on what would normally be considered a good risk. Or it may be that they are willing to lend money, but not as much as the producer or contractor must have.

Many small oil men are not aware that there is another place to turn: the Small Business Administration. Here, in an interview with the Journal, two officials of that independent agency of the federal Government disclose what kind of loans are available from SBA, who is eligible, what the terms are, and how the loans are handled.

An exclusive Journal interview

By Robert J. Enright,
District Editor

J. F. MATCHETT

Need a Loan? Maybe the SBA's Your

Q. The Journal has heard from several sources recently that SBA is becoming increasingly active in extending loans to small businessmen in the petroleum industry. Is this correct?

A. (Stokes) Yes, it is. This regional SBA office now has about 60 loans on the books to all types of small oil concerns in Texas, Louisiana, Oklahoma, and Arkansas.

Q. How long has this been going on?

A. (Matchett) Actually, SBA loans have been available to oil men ever since the agency came into existence in June 1953. But there was little need for our services until the past couple of years. Plenty of financing was available from traditional sources—banks, supply houses, and promotional money. Nearly all of our oil loans have been made during the past 2 years. And "business" is picking up as the word gets around.

The prime reason for this is that the current prolonged period of low allowables has driven a lot of promotion money out of the drilling and producing business. Investors usually want their money back in a hurry. And the reduced rates of production have made 3 and 4-year loans out of many deals that were originally set up for payback periods of only 18-24 months.

Q. How does the SBA define a small businessman in the petroleum industry?

A. (Matchett) In manufacturing industries we draw the line on the basis of the number of employes. This method isn't suitable, however, for the oil industry. We differentiate here on the basis of dollar volume—the gross income per year. If the gross income of a producer or drilling contractor is not over $1,000,000 per year, we consider him a

"We don't lend money to wildcatters. That risk is too big. When we lend money to a producer for drilling, it must be for good, solid, proven locations."

EDWIN L. STOKES

. . . and our interviewees

J. F. Matchett and Edwin L. Stokes, make up an efficient sort of oil team in SBA's Dallas region office. Though they must work with a wide range of industries and businesses and cannot restrict their activities just to oil, they nevertheless have a thorough grounding in oil operations and finance.

Matchett, deputy regional director, was a banker in various parts of the oil patch for many years. From 1919 to 1937—with a 1-year time out to organize a bank in Hobbs, N. M., in 1930—he worked with the National Bank of Tulsa. Later, he organized the First State Bank at Seagraves, Tex., and still later the First State Bank (now the First National) at Andrews, Tex.—both of them in the middle of West Texas oil. Matchett joined the SBA 5 years ago.

Stokes is well acquainted not only with oil finance but also with its day-to-day operational problems. He was a partner in an exploration, drilling, and production company from 1936 to 1941. The partners dissolved the firm with the outbreak of World War II, anticipating impossible operating problems. Stokes joined the Internal Revenue Service. He left this service in 1945 and set up shop as a financial counselor and consultant until joining the SBA in January 1957.

Both men now work under C. W. Ferguson, SBA regional director in Dallas.

Dish. Here's How to Find Out

small businessman and qualified from this standpoint for consideration.

Q. How much money can you allot to a single loan?

A. (Stokes) Our maximum, as set by law, is $350,000.

"We can extend loans up to 10 years. But we prefer not to go over 5 years. We want the money paid back as soon as possible . . . but from the company's earnings."

Q. At what rate of interest?

A. (Stokes) Rate of interest is also set by law at not less than 5% and not more than 5½%.

Q. How about the loan term?

A. (Stokes) We can extend loans for up to 10 years. But we prefer not to go over 5 years. Each one stands on its own. We want the money paid back as soon as possible. But we want it paid back from earnings of the business. We don't want it to come out of the company's capital structure. We attempt to analyze its financial situation and future earnings capacity and fit the loan terms to this analysis so that repayments **can** be made from earnings.

Q. How do such terms stack up with, say, bank loans? The average term is longer, isn't it?

A. (Matchett) Yes, usually, and the interest generally a bit lower.

Q. Supposing a producer meets SBA's definition of small businessman, are there other general requirements before he can be considered for a loan?

A. (Stokes) There are several. First, the company must be autonomous—it cannot be owned or have any sort of corporate ties with a larger firm. Secondly, the company cannot be defunct. SBA is not in business to invest taxpayers' money in hopeless causes. If a business is too far gone, our type loan is out of the question. We try to give free enterprise

"We try to give free enterprise a boost by helping good businessmen help themselves. We feel this generates more good business and helps the over-all economy."

"If you planned to pledge tools or equipment, we would require an accurate description of such equipment and an evaluation of its present worth."

a boost by helping good businessmen help themselves. We feel this generates more good business and helps the over-all economy. Third, we cannot make a loan if the oil man can obtain the credit he needs elsewhere—from banks or supply companies. And fourth, the purpose for which he wants the money must qualify. We lend money only for certain types of oil operations.

Q. What types?

A. (Stokes) Well, a producer may need money to drill added development wells in a field when offset by another operator. He must protect himself and keep his royalty owners off his back. Or, a drilling contractor might want to upgrade his rigs to take advantage of a situation wherein, by this upgrading, he could bring in added business. Or he may need money to tide him over until he is paid for work he is doing or has already done. Most contractors experience a considerable delay, usually 60 to 120 days, from the time they complete a job until the time they are paid for it. Or a service company may need money to modernize its equipment or to market a sound new tool or service. We are willing to lend money for all these and many other purposes if they appear to us, after investigation, to be good risks.

Q. You didn't mention loans for wildcat drilling.

A. (Matchett) We don't lend money to wildcatters. That risk is too big. When we lend money to a producer for drilling, it must be for good, solid, proven locations. And, as with any other lending institution, the loan must be secured adequately with reserves or equipment or both.

One other thing—we do not lend money for purchases of production.

Q. Supposing I were a small oil producer. How would I go about getting an SBA loan to drill up some proved locations, for instance?

A. (Matchett) You should come down and discuss it with us. We would give the deal a cursory examination at that time. If a quick look at the deal discloses that the SBA can't make the loan, we could so advise then. If you appear to qualify, we would go into it deeper.

We would want to take a look at your financial statements for the past 3 years, plus other records, production data, etc. These data would be required before we could form estimates on future earnings and ability to pay. We would also need an evaluation of reserves or equipment that could be collateralized for the loan before we could approve it. Valuation of reserves must be made by a qualified firm—and we would investigate to make sure that firm is reliable.

If you planned to pledge tools or equipment, we would require an accurate description of such equipment and an evaluation of its present worth. The producer shouldn't spend a lot of money to get such worth estimates. The supply house usually is willing to do that for him.

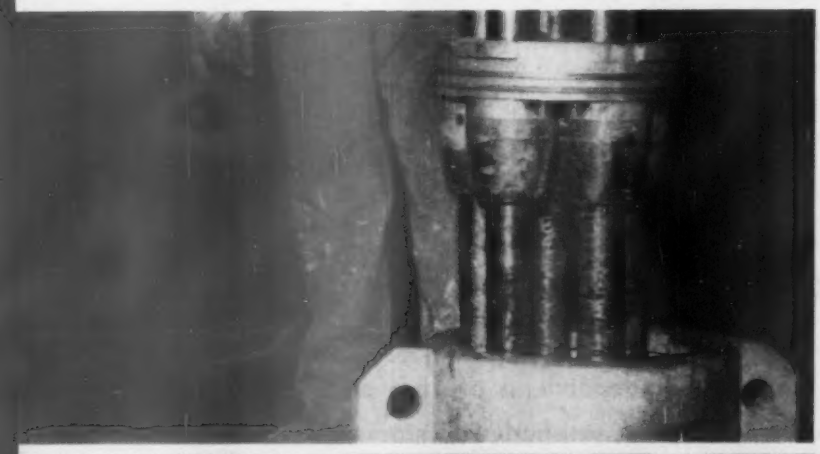
We do send out an appraiser—an engineer on our staff—to appraise the tangible, aboveground assets. As to reserves evaluations, however, we merely check into whether those doing the estimates are recognized reputable engineers. If so, we accept their estimates.

Q. Must this producer come to the Dallas office to talk over a loan?

A. (Stokes) Not necessarily. The SBA has 15 regional offices over the country. The Dallas region is Region No. 10 and takes in all of Texas, Louisiana, Oklahoma, and Arkansas. We have branch offices throughout the region at Little Rock, New Orleans, Oklahoma City, Tulsa, Houston, San Antonio, and Lubbock. The producer could initiate his request for a loan and talk over the deal with SBA personnel at any one of them.

Other regional offices, each with well-distributed branches, are located at: Cleveland, Chicago, Kansas City, Denver, San Francisco, Los Angeles, Philadel-

FIRST FIVE-STRING COMPLETION . . .



Sinclair Oil and Gas Company recently completed the world's first quintuple string producer. OCS 0439, Well #6, Block 190 field, Eugene Island area, Offshore Louisiana, is the first well in the petroleum industry to produce five zones simultaneously from one well through five strings of production tubing. The participants are: El Paso Natural Gas Company, Peoples Production Company, Sinclair Oil and Gas Company and Sohio Petroleum Company.

When this well was raising questions about equipment, we had the answers on packers. A Brown H-S hydraulically-set retrievable five string packer had already been built and tested—was actually waiting for the well we knew would eventually need it. Our other packers in this completion and the Brown multi-string slips and elevators used to run them have taken many kinks out of the tricky but profitable multi-zone completions. Sinclair's five-string is the latest success in a development program which has made Brown the leader in production tools for over a quarter of a century.

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phia, Richmond, Atlanta, New York City, Boston, Minneapolis, Seattle, and Detroit.

Q. When the oil man successfully negotiates an SBA loan, where does he make payments?

A. (Matchett) Sometimes direct to the SBA, sometimes to a bank, depending on the individual deal. Mr. Stokes mentioned earlier that we do not lend money if the producer can get it from other sources. But if an oil man can get some money from a bank, for instance, but only part of the required amount, we may cooperate in the financing and lend him the rest. In such cases, the bank usually handles the entire deal. Payments are made to the bank, and the oil man hardly knows the SBA is in it.

And actually, we prefer it that way. Our loans to business generally are so diversified that we cannot set up large specialized departments. A large oil department like that maintained by many banks in the oil country is out of the question. Too, we're relative newcomers to the petroleum industry. So all told, we are pleased to have the bank handle such a joint operation.

When the oil man is unable to get partial financing from some other source and we are the sole lender, repayment of course is direct to SBA.

Q. Can you trace through a couple of loan case histories?

A. (Stokes) Well, one good example was a West Texas contractor who borrowed $150,000 about 3½ years ago. At that time he had one rig with a depth capacity of about 6,000 ft. His financial situation appeared sound. But his clients were delaying up to 4 months in paying him for work he had done. This was blocking an expansion he had planned. The contractor wanted to upgrade his one rig to drill to 9,000 ft. and to buy a second new rig. For the older rig, he needed a new mast and engine. Also his drill pipe was getting thin and he needed more of that. It appeared to us his earnings potential with the new and upgraded equipment would be very good.

This man now has eight rigs and has expanded to operate also in the Rocky Mountains. He has made good progress in paying back the 5-year loan. Furthermore, I understand he has more business than he can handle and is planning to buy two more rigs.

In a second case, a producer needed to drill some proved locations to protect himself due to offsets put down by another operator. We examined the proposition, found it sound, and lent him $250,000. He also is making satisfactory progress in repaying the loan.

In both these cases, we are participating in the financing with a bank. And the bank is handling the entire deal. And in each case, the bank was willing to lend, and did lend, part of the money. It would not lend the entire amount because the borrower wanted to pay it out over 5 years. The banks would not go for a payout longer than 30 months.

Texas Holds Production to 8 Days for June

• Output will be up slightly. Several factors indicate that the crude market is beginning to firm a bit. Independents are not pushing hard for allowable cuts and most majors seem satisfied with stocks.

TEXAS will hold a tight rein on its production of crude oil through June.

In an unusually short allowable hearing at Austin last week, the Texas Railroad Commission retained for June the restricted 8-day producing pattern now in force for May.

Texas oil wells will produce slightly more next month, however, due to the shorter month. The June allowable was fixed by the commission at 2,643,516 bbl. daily. This is a boost of 55,439 bbl. daily from the allowable in effect May 7 and an increase of 68,622 bbl. daily from the initial May figure.

Market firming?. . . Several factors apparent at last week's hearing indicated the crude market is beginning to firm a bit and that the spectre of another general round of crude-price cutting may have been averted.

For one thing, there was a notable absence of independent testimony. In recent years, Texas independents have usually descended on Austin to push hard for allowable cuts when crude prices appeared shaky.

Most major buyers appeared fairly optimistic. With a couple of exceptions, they seemed satisfied with their stocks positions.

Lastly, the 8-day allowable for June should help cement a firming trend in that the majority of purchasers nominated for 9 days.

In the 9-day bracket were: Sun Oil Co., Humble Oil & Refining Co., Texaco, Mobil Oil Co., Shell Oil Co., and Standard Oil Co. of Texas. Nominating 8 days were Atlantic Refining Co., Cities Service Oil Co., and Gulf Oil Corp. On the low 7-day side were Indiana Oil Purchasing Co., Sinclair Crude Oil Co., and Phillips Petroleum Co.

The biggest buyers of Texas crude, however, are in the 9-day group.

Too, there are special situations in the lower group. Indiana, for instance, is still troubled with crude from its connections that piled up in field storage during its long refinery strike. Sinclair cut its nominations at the last moment due to the loss of a big fluid unit at one of its refineries.

TEXAS ALLOWABLE BY DISTRICTS

District—	June	Decrease from May 7
1. Southwest	53,026	1,376
2. Gulf Coast	106,379	2,663
3. Gulf Coast	343,137	6,224
4. Southwest	173,321	3,503
5. East Central	28,026	459
6. Outside East Texas Field	109,183	2,835
6. East Texas Field	123,826	3,511
7-B. N. Central	149,448	3,445
7-C. W. Central	131,117	2,165
8. West Texas	1,035,697	24,643
9. North Texas	259,717	2,714
10. Panhandle	130,639	1,901
TOTAL	2,643,516	55,439

Ohio Oil Gets Big Strike In Delaware Basin

THE FAST-GROWING hunt for Pennsylvanian production in the northern reaches of the Delaware basin turned up one of New Mexico's biggest gas-condensate discoveries last week.

The prolific producer is Ohio Oil Co.'s 1 Andrew Armquist-State, 1 mile southwest of Dayton in central Eddy County. It was completed for a calculated open flow potential of 545,000 M.c.f. daily from perforations in the Bend Pennsylvanian at 9,060-84 ft. and 9,092-9,120 ft. Estimated gas-condensate ratio was 100,000:1.

This discovery may well be one of the most significant hits in Delaware basin shelf country this year. Its prolific flow gives an inkling of the possibilities for those seeking Pennsylvanian production throughout the northern shelf and basin.

Recently there has been a flurry of gas discoveries in the lower part of the Pennsylvanian in southeastern New Mexico. Most of them have been up on the northern shelf of the basin,

but there are also some new strikes in the basin proper.

The most important of these was Gulf Oil Corp.'s 1 Estill in southern Eddy County. It flowed 47,000 M.c.f. daily on open flow with 4 bbl. of condensate per 1,000 M.c.f. of gas from Atoka, also basal Pennsylvanian, at 9,806-16 ft. This well is 16 miles south of Carlsbad.

Another promising well is Humble Oil & Refining Co.'s 4-1 Huapache, 22 miles west of the Gulf well. Humble is testing gas in the Pennsylvanian. Successful completion here would move production to the westernmost point in the entire Permian basin geological province (OGJ, May 9, p. 233).

Mobil Oil Co. recently completed the first Pennsylvanian producer in the Texas portion of the Delaware basin. The 1 Moore in Pecos County flowed 102,000 M.c.f. daily and 1,500 bbl. of condensate per day from 15,147 ft. It is the deepest producer in West Texas and the most important wildcat there since the Brown-Bassett field was opened. (OGJ, March 7, p. 64)

Oil-Change Period No Problem

. . . for car owners, dealers. There's no resistance to frequent drains, API lube committee study shows.

AUTOMOBILE owners and dealers are more receptive to frequent oil changes than many people think. Here's what the API Lubrication Committee found in surveys of these two groups:

None of 1,500 owners of new Chevrolets, Fords, and Plymouths regarded "extended oil-drain interval" as a reason for buying a car. In fact, 42% drain at 2,000 miles or less. Actual average drain periods are: Chevrolet, 1,500 miles; Ford, 2,050; and Plymouth, 1,600.

Interviews of 2,000 dealers showed that 80% regard oil change business as important; that 85% prefer a drain period of 2,000 miles or less; and that dealers, on the average, favor oil drains at 1,833 miles against 2,846 miles recommended by manufacturers.

These results were revealed by R. Cubiciotti, vice president, Sonneborn Chemical & Refining Corp. at the lube committee's meeting in Bedford Springs, Pa., last week. He told the group that "many oil companies report an improvement in their motor oil-gasoline ratios" since the committee's campaign began.

Last year the committee approved a simplified oil-drain practice recommendation at its meeting in Des Moines: "In Winter—Every 30 Days; In Summer—Every 60 Days; But Never Exceed 2,000 Miles." It made a postcard survey of participating companies last month and found that 91% were going along with the recommendation and that the remaining 9% intended to do so.

Henry T. Rockwell, president of the agency handling the committee's public relations program, also found that car owners are lube conscious. He said that an agency-sponsored study of owners of cars of all ages found that 66% observed a drain period of 2,000 miles or less. An overwhelming majority, he said, reported that they had not changed their oil-change practices in 3, 5 or even 10 years.

North Texas Stripper Floods Proposed

NORTH TEXAS operators have filed with the Texas Railroad Commission for permits to carry out two large stripper floods.

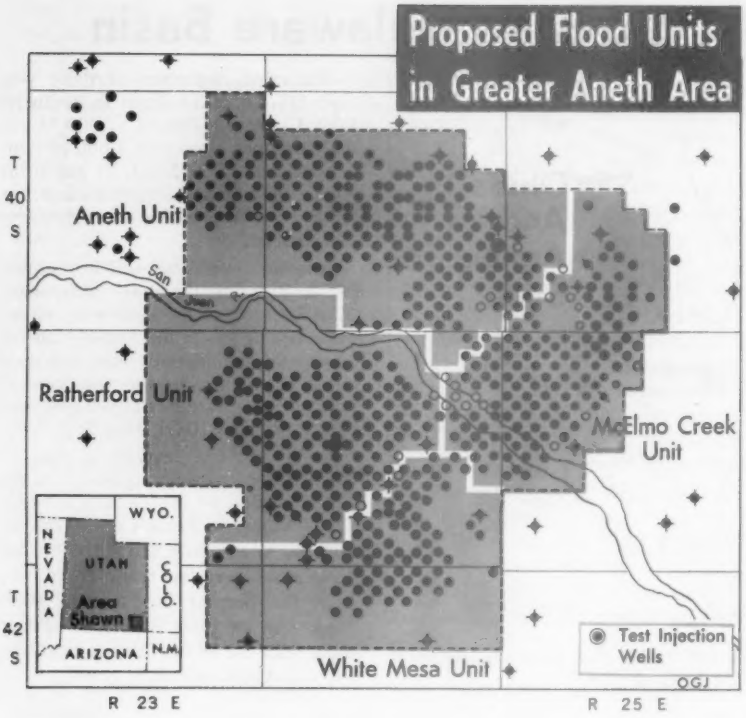
Three Bee Investment Co. sought approval of a unit and flood which it estimates will add about 5,500,000 bbl. of oil to ultimate recovery from the Bryson Unit in East Bryson field of Jack County.

And W. T. Waggoner Estate proposed a unit and flood for the Milham sand under 1,090 acres in the East Milham sand area of Wilbarger County Regular field. It estimated a resulting boost in oil production of about 2,200,000 bbl.

The Bryson Unit would take in about 1,800 acres and 45 wells, each making about 8½ bbl. a day. This field was discovered in April 1928. It produces from the Bryson sand between 2,900 and 3,000 ft.

The East Milham Unit would take in 58 producing wells now averaging about 2 bbl. a day each. Cumulative production from the 2,400-ft. sand to March 1 was estimated at 3,362,-644 bbl. Flood cost was set at $1,250,000.

Both projects will employ five-spot patterns and inject water through closed systems.



Flood Proposed in Aneth

• Big producing area has been split into four units to expedite water flood. First injection may begin early next year in McElmo and Aneth units.

A KING-SIZE water flood for the Greater Aneth field of San Juan County, Utah, is nearing a reality.

Four units, covering about 500 wells and 50,000 productive acres, are being formed.

Anticipated primary production of 160,000,000 bbl., from 16 to 18% of oil in place, will be more than doubled by secondary recovery. The flood program is expected to continue 11 to 15 years.

About 310 wells in the Aneth and McElmo Creek sections of the pool may be under flood by January 1961. The Ratherford and White Mesa units, to the south, are not so far along. They should be ready later next year.

Plans for the four floods must be approved by the Utah Oil and Gas Commission. Aneth and McElmo Creek negotiations are in late stages and formal applications to the commission are expected soon. Work on the White Mesa and Ratherford units is proceeding slowly.

The commission has set a hearing on the secondary recovery plans for September 20. However, it has asked that operators make progress reports each 60 days showing how negotiations are proceeding.

Production in Greater Aneth, discovered in 1956, is about 90,000 bbl. of oil daily. The four proposed units, operators, and major participants, stack up like this, with much negotiating and organization work yet to be done:

... **Aneth unit**—Texaco Inc., operator; Gulf Oil Corp.; Shell Oil Co.; Humble Oil & Refining Co.; Cities Service Oil Co.; Three States Natural Gas Co.; Pure Oil Co.; and Petro-Atlas Corp.

... **McElmo Creek unit**—Superior Oil Co., operator; Humble; Phillips Petroleum Co.; Texaco; and Continental Oil Co.

... **Ratherford unit**—Phillips, operator; Shell; Superior; Texaco; Standard Oil Co. of California; and Aztec Oil & Gas Co.

... **White Mesa unit**—Continental, operator; Humble; Phillips; Superior; Texaco; and Pure.

Why four floods? ... Engineering and operating committees named to establish units for secondary recovery recommended the four-way split because:

1. Organization of smaller units is speedier than trying to get operators in the over-all area agreed on participation schedules.
2. Reservoir conditions vary in the field, although all four areas have a common source of supply.
3. Geography of the area varies, making operating problems different in different sections.
4. Each of the four areas is in a different stage of development.

Flood-type undecided ... It's too early for decision on how the floods will be operated.

If a pattern flood is used, probably 200 to 240 injection wells would be required to inject from 120,000 to 200,000 bbl. of water daily. The Desert Creek zone at 5,600 ft. is the principal producing horizon.

Source of water for flooding is another matter still under study. It could be obtained from gravel beds adjacent to the San Juan River, which flows through the field. Wells 20 to 45 ft. deep would have to be sunk to get this supply.

Water could be obtained from the DeChelly sands at about 2,400 ft. This source may get the nod from operators since gravel-bed water is needed for irrigation in the arid Aneth regions.

Two pilot injection wells are operating. Texaco has one in the Aneth unit area and Phillips operates one in Ratherford. Both are injecting salt water. Results of these injections will be studied in determining final flood procedures.

The Desert Creek zone is a reef-type carbonate buildup of Pennsylvanian age. The productive section has an average gross thickness of 170 ft., with approximately 40 ft. considered net pay.

The reservoir generally is characterized by three porous subzones stratified by relatively dense carbonate. The upper is interbedded limestone and dolomite with intergranular porosity development.

The middle zone is largely limestone with a more vugular type porosity. The lower zone is a porous dolomitic limestone not now considered commercially productive. The chief producing mechanism in Aneth is solution gas drive.

Since the field was discovered 4 years ago, it has produced more than 67 million barrels of oil.

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DRILLING CONTRACTORS attended an ICC meeting in Dallas last week to protest a proposed increase in trucking rates.

Rig Moving Costs May Be Increased

• AAODC spearheads to kill rate increases proposed by truckers. New rates would increase rates from 5 to 15% on moves under 150 miles.

DRILLING contractors leveled heavy fire in Dallas last week at a proposed hike in interstate rates for trucking oil-field machinery and pipe.

The higher hauling tariffs were proposed by the Oil Field Haulers Association for adoption by the Interstate Commerce Commission in a hearing before an ICC examiner at Dallas' Sheraton Hotel.

The Dallas hearing was the latest development in a truck-rate hassle which has extended over several years.

The drilling contractors argued that the proposed new rates would discriminate against them in that most of the boost would fall on short-distance hauling of machinery—namely rig moves. The increase, they figure, would range up to 15% for moves under 150 miles.

The contractor battle against the OFHA rate proposal was coordinated by the American Association of Oilwell Drilling Contractors.

Warren L. Baker, AAODC executive vice president, testified that the contract drilling industry could ill afford any increase in rig-moving bills, much less one on the order of that under consideration.

The increase is discriminatory, he said, in that it "proposes large advances on short hauls and on machinery moves, but relatively small increases or none at all on long hauls and on line hauls."

"The majority of rig moves will be less than 150 miles. Many will not exceed 50 to 100 miles. Thus, the burden of paying proposed higher hauling rates will fall largely on the oilwell contract drilling industry."

Traffic tests . . . Evidence presented by AAODC in opposition to the rate hike included traffic tests on actual rig moves comparing present costs with costs that would be incurred under the new rates.

On some of these involving big rigs, AAODC calculated increases in moving costs ranging up to about $900.

AAODC says the new rates would hike the cost of moving rigs from 5 to 15% for moves of 150 miles or less—with the biggest increase for the shortest moves.

It is difficult to figure exactly how much more the boost would cost contractors, Baker said, because charges for loading and unloading that now are separate and distinct from hauling tariffs are lumped into the proposed new tariffs.

Operate own trucks? . . . If the truckers insist on and get such a rate raise, Baker said, they may find that "they are pricing themselves out of business so far as rig moves are concerned."

The AAODC official predicted that an immediate result of adoption of the proposed new rates would find contractors buying and operating more trucks.

"Recent years have seen a number of drilling contractors increase their trucking capacity. This trend will gain momentum if the proposed rate schedules are adopted," Baker warned.

Shippers watch scrap . . . The Shippers Oil Field Traffic Association, which includes as members most major oil companies, did not oppose the rate boost as an assoication.

Some of its member companies, however, did object.

SOFTA in recent years had been one of the leading opponents of pre-

PIPELINE

A 94-mile 18-in. line is planned by Mississippi River Transmission Corp., a subsidiary of Mississippi River Fuel Corp., from the Trunkline Gas Co. system near Johnsonville, Ill., to the St. Louis area. The new company's FPC application reports plans for the line and underground storage facilities at St. Jacobs field in Illinois, with the entire project to cost $9,118,925. Laclede Gas Co., St. Louis, will buy 42,500 M.c.f. daily and Illinois Power Co., Decatur, Ill., will buy 7,500 M.c.f. daily to be purchased from Trunkline.

Double-jointing contract for 154 miles of the 500-mile 24-in. Midwestern Gas Transmission Co. line from Emerson, Man., to Marshfield, Wis., has been awarded to H. C. Price Co.

vious unsuccessful rate-boost proposals by the truckers. Most of the features objectionable to them, however, were apparently ironed out earlier this year in negotiations between the two associations.

AAODC, Baker said, did not have a voice in these negotiations.

The contractors got some indirect support at the Dallas hearing from a dissident trucker. Mercer Trucking Co., a large oil-field hauler based at Fort Worth, opposed the proposed new rates.

Truckers costs up . . . Witnesses for the Oil Field Haulers Association testified that the rate hike is needed to bring shrunken profits back up to respectable levels.

They pointed out that cost of all equipment and labor used by truckers has gone steadily upward while truck rates have remained static.

This view was supported by an ICC study which found trucker costs to have increased about 5% from 1957 through the third quarter of 1959.

The examiner wrapped up his hearing in Dallas last week and instructed parties in the dispute to file reports with him by July 11. After receiving these reports, the examiner will make his recommendation to the ICC. No further hearings are expected unless the full commission calls for hearings after receiving the examiner's report.

If the truckers are successful in pushing through new higher tariffs for interstate traffic, they reportedly then will file with the proper state commissions for approval of the same rates for intrastate hauling.

Joint Seismic Deal Cuts Cost

EIGHT COMPANIES have just finished an unusual mass seismic check of an area on the Lisbon anticline near Pure Oil Co.'s Northwest Lisbon discovery in San Juan County, Utah.

First phase of the cooperative geophysical activity, handled by Tower Exploration, Inc., of Denver, has been completed.

For $5,000 each, the companies received results of 1 month's shooting, including:

. . . A basic interpretation of seismograph work completed.

. . . Magnetic tapes of the entire shooting program for their own evaluation.

Companies which participated in the first 30-day program are Atlantic Refining Co., British American Oil Producing Co., Mobil Oil Co., Sun Oil Co., Richfield Oil Corp., Pubco Petroleum Corp., Tidewater Oil Co., and Union Oil Co.

Five of the companies have contracted jointly with Tower for further checks in the area. They are British American, Sun, Richfield, Pubco, and Tidewater.

The original work, begun 2 months ago with three rigs and a crew of 19, included about 100 shot points and results of work along 25 miles of dip and tie lines. Since there is little open acreage in the area, results of the seismic work probably will be used to appraise producing structures.

Two factors played key roles in flanging the joint operation.

One was the need for a quick check of the area, already proven productive and the center of feverish land and drilling activity. The second was the chance to gain basic information at a fraction of regular cost.

Estimated cost of maintaining a seismograph crew for a month averages about $30,000. Costs in tough terrain can mount to $3,000 a day. By pooling efforts, the companies had shooting work done for one-sixth to one-eighth of what it would cost to use their own crews.

In signing for the "farmed out" seismograph work, the companies agreed to keep the information tight for 6 months. This provision prevented at least one company from joining the venture.

Petrochem Complex Planned

BORDEN CO. and U. S. Rubber Co. have formed a jointly owned chemical company to construct an acetylene and vinyl chloride monomer plant on the Gulf Coast.

The plant will be the center of a $50-million complex of chemical plants. Site of the complex will be somewhere between Corpus Christi and New Orleans. Site surveys are under way.

Borden and U. S. Rubber have organized Monochem, Inc., to build a plant with an initial capacity of 80 million pounds of acetylene and 150 million pounds of vinyl chloride monomer yearly. Borden and U. S. Rubber each will then erect its own plant to use Monochem's output for other chemical products. The Monochem plant will be completed in 1962.

BRIEFS . . .

Bids are due May 31 on five loops totaling 60 miles of 30-in. and 15 miles of 26-in., plus other projects including 41 miles of 30 in. and 14 miles of 24-in. for Northern Natural Gas Co. The work is located in Texas, Oklahoma, Kansas, Nebraska, and Iowa.

The 371 miles of 30-in. loop planned by Peoples Gulf Coast Natural Gas Pipeline Co., now before FPC, will be divided into six schedules with separate contracts. Peoples reports that construction must start by July 1 if a November 1 completion deadline is to be met. A similar construction schedule is estimated for Peoples' sister company, Natural Gas Pipeline Co. of America, for 151 miles of 36-in. loop and a new 180 mile 24-in. line in Oklahoma.

Two more spreads will soon start work on the Mid-America Pipeline Co.'s LPG line from Eunice, N. M., to Minneapolis, Minn., and Madison, Wis. Spreads working out of Pampa, Tex., and Pratt, Kans., had laid more than 120 miles of the 2,300-mile system last week. Spread No. 3 will lay 340 miles of 8-in. from Conway, Kans., to Macon, Mo., starting May 30; spread No. 4 will lay 60 miles of 8-in. and 290 miles of 6-in. from Macon to Madison, Wis., starting June 6.

A pipeline to take crude from southwest and southeast Saskatchewan and U. S. Williston basin fields to Minneapolis-St. Paul markets has been approved in principal by the Canadian Senate. Northern Pipe Line Co., subsidiary of Minnesota Pipe Line Co., will seek National Energy Board approval to export 26,000 bbl. daily from southwest Saskatchewan and 12,000 bbl. daily from southeast Saskatchewan fields through a 153-mile 16-in. line starting at Regina, Sask. The Canadian section would cost $10,500,000. The line would be extended from the international border, near Portal, N. D., to Clearbrook, Minn., where it would connect with Minnesota Pipe Line.

Twin 8-in. products lines are being built by Standard Oil Co. of California from its new 35,000-bbl. daily refinery, to be operating this October, some 20 miles eastward to Honolulu. Bechtel Corp. has the contract. A 20-in. fuel-oil line and a 30-in. crude line will run 12,000 ft. into the Pacific to a mooring area for tankers.

Jobbers Look at Problems

. . . at Washington meeting. One complaint: Supplier sales at prices below what jobbers are required to pay.

OIL JOBBERS, meeting in Washington last week, discussed a wide range of problems which plague them and other segments of the industry.

The occasion was the annual mid-year meeting of the National Oil Jobbers Council.

Depressed prices, excessive refinery runs, import controls, taxes, antitrust laws, jobber-supplier relations, and fair-trade legislation were among the topics drawing attention.

E. K. Bennett, NOJC president, put his finger on excessive refinery runs as the chief culprit.

He said too much throughput at refineries leads to downward pressure on prices and to such "unfair" practices as suppliers selling to commercial customers and others at prices below those the jobber has to pay.

Bennett said he had seen no indication that the suppliers were going to stop this practice. However, he said, most integrated suppliers are taking a fresh look at their marketing practices and "it is my belief there will be some changes made."

Otis Ellis, NOJC general counsel, warned the jobbers of another problem they may be facing soon. He said that legislation may be passed by Congress this year to raise the minimum wage and to extend coverage of wage and hour provisions. To help prevent passage of this legislation, which the NOJC opposes, Ellis urged jobbers to write or call their congressmen.

Ellis also said he had been given information which caused him to wonder if a concerted effort is being made to reduce the jobber's normal margin on regular gasoline from 3¼ cents a gallon to 3 cents, with proportionate decreases in the margin on premium gasoline.

Ellis said he was aware that some jobbers were not actually getting the 3¼-cent margin now and therefore might reason that they would be better off with a real margin of 3 cents than a "fictional" normal margin of 3¼ cents.

But, he warned, a reduction of the normal margin to 3 cents still would not be a guarantee that the jobber would actually get that much.

"In my judgment, every legitimate effort to resist marginal decreases should be made by this council," Ellis said.

Proposals . . . On the final day of the 4-day meeting, the jobbers acted on a variety of resolutions and reports drafted by committees and subcommittees earlier in the week.

One committee recommendation which was approved called for revision of jobber contracts to allow franchise jobbers to purchase distressed or surplus material—or be allowed to purchase products elsewhere—at a price that would enable them to compete for commercial accounts.

NOJC's E. K. Bennett

Other committee recommendations included the following:

. . . **Continue opposition** to the proposed federal fair-trade bill in its original form.

. . . **Seek legislation** or an administrative ruling that farmers be required to show proof that they have paid for the gasoline upon which they are seeking a federal gasoline tax refund.

. . . **Reaffirm NOJC** policy of opposing business establishments on interstate highway rights-of-way.

. . . **Oppose legislation** which would authorize a fuels study by a special congressional committee.

PROCESSING BRIEFS . . .

Goodyear Tire & Rubber will build a multimillion-dollar plant for the production of polyisoprene and polybutadiene, two new synthetics which can be used as extenders or replacements for natural rubber (OGJ, May 16, p. 99). The new plant will be located near Mobil Oil's Beaumont, Tex., refinery and is expected to be in operation within 1 year.

Consumer tests of tetramethyl lead will begin May 24 at 84 Mobil Oil stations in the Syracuse, N. Y., area. Tests will be limited to Mobilgas Special, the premium grade. Standard of California became first company to use TML generally last month after Mobil had announced promising results with the new antiknock agent in January. Ethyl Corp. will supply California Standard and Du Pont will supply Mobil. Ethyl and Du Pont have limited TML production, but both are pushing construction of new facilities.

An expansion program at the Gilsonite ore refinery of American Gilsonite Co., will almost double capacity of the plant near Grand Junction, Colo. When work is completed late this spring, daily output is expected to be 1,600 bbl. of gasoline, 1,300 bbl. of railroad fuel, and 350 tons of coke.

Mobil Oil will start construction soon at its Beaumont refinery of a delayed coking unit with a charge capacity of 20,000 bbl. daily. The coker is scheduled to go on stream in the spring of 1961. It will be the third to be built by Mobil in the past few years. Others are at Paulsboro, N. J., and Torrance, Calif. The Torrance unit went on stream last February.

Ultrapure methane (99.99%) will be produced from methane-rich natural gas by Allied Chemical Corp. at its Moundsville, W. Va., plant. The processing will be carried out at very low temperatures in a single compact cold box designed and built by Air Products, Inc.

Tidewater shut down its Long Lake field cycling plant in Anderson County, Texas, recently after 20 years of operation. Running the plant, which is owned by Tidewater and Texaco-Seaboard, Inc., was no longer an economic proposition, Tidewater said. Gas throughput has been running only about 15,000,000 cu. ft. daily, compared with a design capacity of 60,000,000 cu. ft.

International Oil Controls Predicted

• Atlantic Refining vice president says controls of some sort will emerge from the present world surplus of crude since too many powerful groups are being hurt by the glut of oil available on today's market.

SOME form of international control of the world's crude-oil surplus is coming—and soon.

That prediction, coming last week as it did on the heels of international proration proposals from leading Arabs and Latin Americans, was not too startling. In fact it had a familiar if not wholly pleasing ring to the oil industry.

It was the source of the prediction that was a little startling. It came from the financial vice president of Atlantic Refining Co., Thornton F. Bradshaw.

Bradshaw's admission that the industry generally would take a dim view of controls over its normal operation was probably the understatement of the week. But he minced no words in talking to New York's Financial Analysts about the prospects for some form of control to keep the oil surplus from getting out of hand.

"I cannot forecast the form the control will take," he said. "I am convinced that control of the surplus of some sort or another will become effective and in the relatively near future.

"Too much is at stake to allow the international oil situation to deteriorate into chaos. Too many powerful groups—both private and government—are too well aware of the implications of an uncontrolled oil situation to allow it to develop.

"I am not speaking of rate of return on oil-company investments—I am speaking of the economic base of the free world."

Bradshaw's comments followed closely the international proration proposed earlier this month by Sheikh Abdulla Tariki, Saudi Arabia's director general of petroleum and mineral affairs. Tariki unveiled his personal plan for stabilizing world oil prices through market proration based on proved reserves at TIPRO's annual convention in Tyler, Tex. (OGJ, May 9, p. 99).

A week later, Tariki voiced his plan again in a Caracas press conference held with Dr. Juan Pablo Perez Alfonzo, Venezuela's minister of mines and hydrocarbons, who advocates more cooperation between Latin America and Middle East oil.

Atlantic's Bradshaw
. . . international controls are coming.

Both Tariki and Perez Alfonzo are well known for their theories that the governments of oil producing countries, especially their own, should have more control and more to say about how the oil is produced, sold, and at what price. Bradshaw, as an executive of a private oil company, is a little different. The U. S. oil industry has long battled any form of government interference or control.

The first step of Latin American-Middle East cooperation was taken last year at Cairo's first Arab Oil Congress attended by Perez Alfonzo and a large delegation of Venezuelans.

Since that time Venezuelans in the oil ministry have made official visits to the Middle East and this is Tariki's second visit to Venezuela, a country he admires because it was able to force through a governmental increase in oil income.

Further efforts to foster this East-West cooperation, and weld it into a workable and forceful reality, are expected when the Arabs hold the Second Oil Congress in Beirut in October. A number of Latin American oil producing countries have been invited to attend. Venezuela certainly will be well represented.

Latest indication of the concerted efforts of Tariki and Perez Alfonzo to bring the two major oil producing areas closer together in thinking and practice came last week when Venezuela announced it has invited the Shah of Iran to visit Caracas.

Iran, the only non-Arab oil producing country in the Middle East, has long been conceded to be the weak link in any effort on the part of the Arabs to forge a leakproof agreement on Middle East oil.

Profits to return . . . Bradshaw, who just a few days before was elected president of the Greater Philadelphia Chamber of Commerce, prefaced his "control" remarks by saying he does not claim to be an oil man.

"I have been in the oil business 4 years. As you know, this is scarcely enough to put me in the ranks of those who are born in an oil patch, weaned on crude oil, educated on the Devonian and Ellenburger, and spend their working lives chasing the elusive fortunes of the oil business," the Atlantic vice president told the Analysts.

Bradshaw is a former associate professor at Harvard Business School, a former consultant to both U. S. Steel and the Secretary of the Army, and a partner in a management consultant firm before joining Atlantic in 1956. He was made a vice president and a member of Atlantic's board in 1958.

Here are Bradshaw's primary points in his talk to the analysts:

. . . **The oil surplus** is a blessing, not a scourge.

. . . **Oil profits** are not tied as directly to the elimination of the surplus as many people believe. Too many people believe profits will return to

adequate levels only when the surplus disappears. The surplus is not going to disappear for many years.

... **Profits will return** to normal when oil managements and governments learn how to manage the surplus effectively.

... **Intensified** national interest in oil will create an effective international balancing machinery in some form in the relatively near future.

... **Domestically,** both states and management will use present tools more effectively to deal with the U. S. surplus in the very near future.

... **Effective control** of the worldwide surplus will once again give the oil industry its basic strength as the primary provider of energy.

A history of controls . . . Bradshaw pointed out that a quick look at the history of the industry illustrates that this is not the first time some controls have been needed.

He recalled that in 1926 the "balance of power" previously exercised by seven big oil companies began to deteriorate in a situation "surprisingly like today's picture." The answer, he said, was the Achnacarry Castle agreement made in Britain by representatives of the major oil companies. He described this "as-is" agreement as "the most effective experiment thus far achieved in the 20th Century.

But, he added, times have changed. Today American companies control much more Eastern Hemisphere oil than they did 20 or 30 years ago and it would be impossible for American companies to take part in this kind of an agreement today.

Much of today's surplus is in the hands of new producing companies, all under pressure to push output and recover the investments they have made.

Too, the growth of "national" entities in oil like those in Italy, France, Iran, Argentina, and now Venezuela, is a new factor.

It is the rise of these "national" oil agencies that point to the "most likely" control of the surplus, according to Bradshaw. He thinks also an "informal cooperation" between the larger international companies and the oil producing countries may be effective.

He concedes that "most oil men regard the possibility of successful international proration as being slim," but insists that there are no insurmountable difficulties. To support this contention, he points to the birth of Europe's Common Market and the Outer Seven Economic Agreements.

Backers Found for Huge YPF Drilling Program

• Pan American International and two other firms may assume payments on contracts covering 1,800 wells. The Argentine government's money-short oil company would make repayment as oil is produced.

Yacimientos Petroliferos Fiscales, the Argentine Government oil company, is studying a new plan for refinancing almost $72-million worth of drilling contracts which call for completing 1,800 wells by 1964.

Neither YPF nor the companies involved are ready to discuss the new plan publicly but all reports indicate that Pan American International Oil Co. and two other firms will underwrite the new program.

Money-short YPF is apparently having trouble finding the funds to meet its obligations under the drilling contracts for the 1,800 wells on the south flank of Comodoro Rivadavia field in southern Argentina. Buenos Aires reports last week indicated that Pan American, a Belgium firm, and American banking interests may assume the YPF payments to the contractors and then be repaid by YPF as the oil is produced.

Pan American already has a highly successful drilling operation under way in the country under a separate contract agreement with YPF.

Three contracts involved in the refinancing deal are with Kerr McGee Oil Industries, Inc. They cover drilling of 500 wells at $19.80 per meter drilled ($6.03 per ft.) and $50 an hour for completion work. Under the contracts, Kermac is to be paid 60% in dollars with a 6-month delay provision with no interest. The remaining 40% is payable in Argentine pesos.

Southeastern Drilling Co. has a contract calling for 1,000 wells at $19 per meter drilled ($5.79 per ft.) and $50 an hour for completion work with the same general terms as the Kermac contracts.

Soc. a Azionaria Italiana Perforazoni Montaggi, a subsidiary of the Italian government-owned ENI combine, has a contract for 300 wells at $20.50 per meter ($6.24 per ft.) with the same $50 provision for every hour of completion work.

The Italian company is to be paid 62% in lire over the 4-year period and the remaining 38% in Argentine pesos. The contract provides that 25% of the peso payment may be converted to dollars at the rate of 65 pesos per dollar.

The Comodoro Rivadavia region, which has been producing oil for Argentina since 1907, is expected to give the oil-short country a real shot in the arm in a relatively short time through these drilling operations.

The region will furnish a major part of the oil that will make the country self-sufficient well in advance of the 1964 target date. The area's 1960 production is expected to double last year's output and will reach 225,000 bbl. daily by 1964—if the 1,800-well program is completed.

U. S. Firms Drop African Concession

AFTER two deep tests and $2.5 million spent, two American companies have dropped out of the search for oil in West Africa's Ivory Coast.

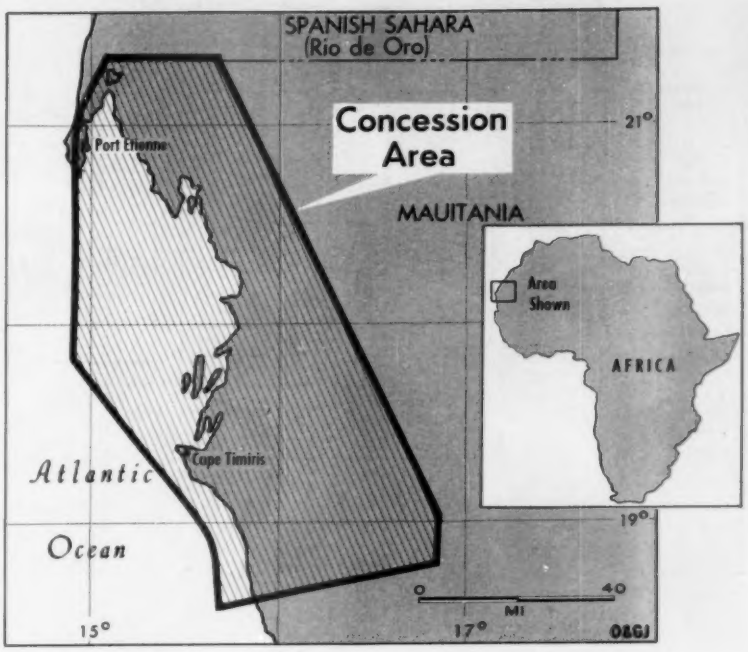
Plymouth Oil Co. and Benedum Trees Oil Co., both Pittsburgh firms, have written off their first venture outside the Western Hemisphere as a failure. Plymouth had a 39% interest and Benedum-Trees 10% of a joint venture with the French company, Ste. Africaine des Petroles, to explore a 2,400,000-acre concession covering what is known generally as the Cretaceous Tertiary basin along a narrow strip of the Ivory's southeastern coastal area (OGJ, Aug. 11, 1958, p. 87).

The French company will continue the exploration. Under the terms of the agreement, the two American companies will be reimbursed for their investment of about $2,500,000 from any oil that is found in the concession.

Decision to give up the venture was made after two deep tests were abandoned as dry holes. One went to below 12,000 ft. and the other below 13,000 ft.

American Companies Share African Grant

• Conoco, Cities Service in on deal for concession in French West Africa.



TWO American oil companies, with a French partner, have been awarded a 5-year exploration license by the Republic of Mauritania on West Africa's coast.

The 38,447-sq. kilometer concession is located just south of the Spanish Sahara region of Rio de Oro which was the most recent hot leasing area of Africa.

The exploration operation will be conducted by PETROPAR, in which the French Government's Bureau de Recherches de Petroles holds the controlling interest. PETROPAR will hold a 51% interest in the new venture. The American partners will be Continental Oil Co. of Mauritania with 25% and Mauritania Cities Service with the remaining 24%.

Just slightly less than one-third of the concession acreage, or 13,852 sq. kilometers, is offshore in the region between Port Etienne and Cape Timiris with a narrow strip of marine territory following the shore line another 55 kilometers (39 miles) south of Cape Timiris.

The two American companies made their joint application with the French in January 1959. The companies have similar interests in an operation in Senegal with other French partners (OGJ, Nov. 23, 1959, p. 58).

Venezuelan Acreage Shed

. . . by firms with big exploration concessions. It looks like another big year for pruning.

COMPANIES operating in Venezuela continue to drop big chunks of concession acreage.

Last year operators released rights to 3.6-million acres, probably the biggest reduction in the country's history (OGJ, Feb. 22, p. 83). But relinquishments so far this year—1.2 million acres—show that companies still are heavily weeding unpromising lands.

Cia. Shell de Venezuela this year renounced 404,976 acres. In Zulia State 10,102 acres were dropped northwest of Mara field, and 64,376 acres were given up south of the city of Maracaibo. Another 48,664 acres were relinquished in Maturin District of Monagas.

The remaining 281,834 acres dropped by the company are located in Anzoategui and Guarico. The biggest concentration of these rights covered 108,463 acres in Cagigal District of Anzoategui.

Esperanzo Petroleum renounced 73,697 acres in the Cagigal area, while Caracas Petroleum dropped 24,273 acres in Guarico.

Pan Venezuela released 11,113 acres in the Jobo area of southern Monagas and three exploration parcels covering 74,100 acres in southern Apure.

Texaco gave up 182,407 acres in the Buchivocoa area of Falcon. Creole let concessions go covering 252,893 acres in Guarico. Venezuela Atlantic dropped 89,241 acres in Anzoategui and Guarico, 53,204 acres in Barinas Block 27, and two exploration blocks in Apure covering 49,400 acres.

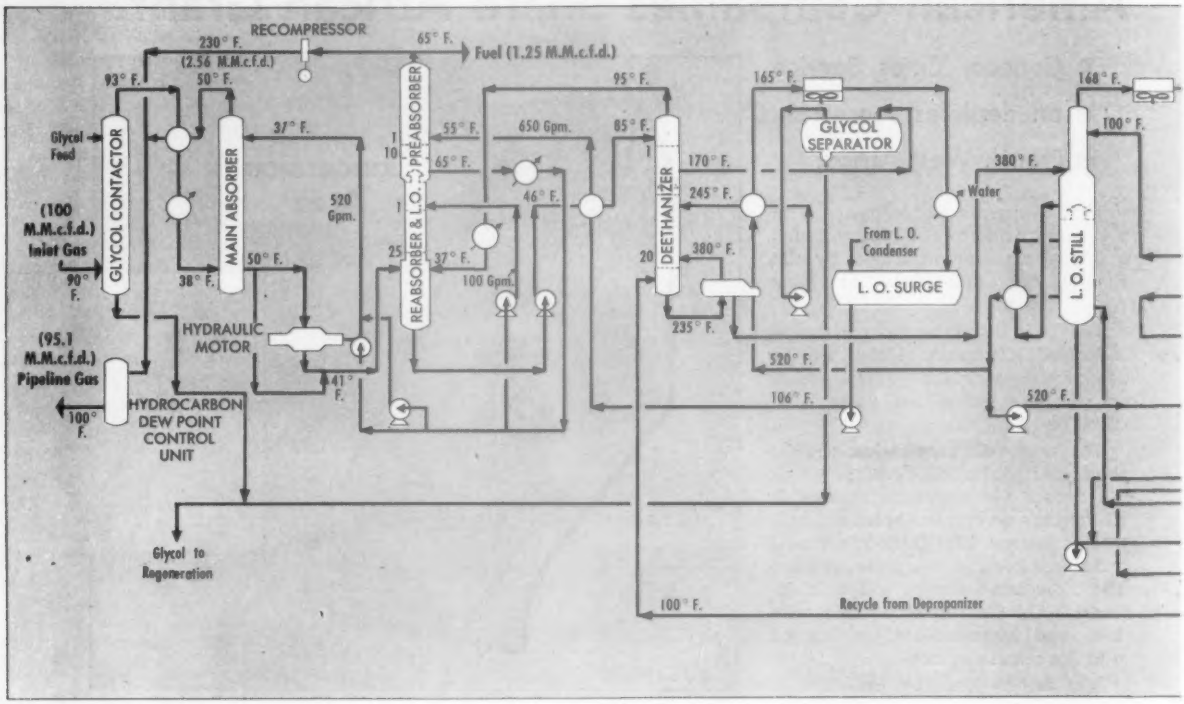
Output in Nigeria May Take Big Jump

NIGERIAN crude production may reach 200,000 bbl. daily within a decade, putting the country among the ranks of the world's most important producing countries.

This prediction was made by R. P. R. McGlashlan, managing director of Shell-BP (Nigeria), who said that if progress continues at the present rate, the country should be producing 10-million tons per year within 10 years. This is about 200,000 bbl. daily.

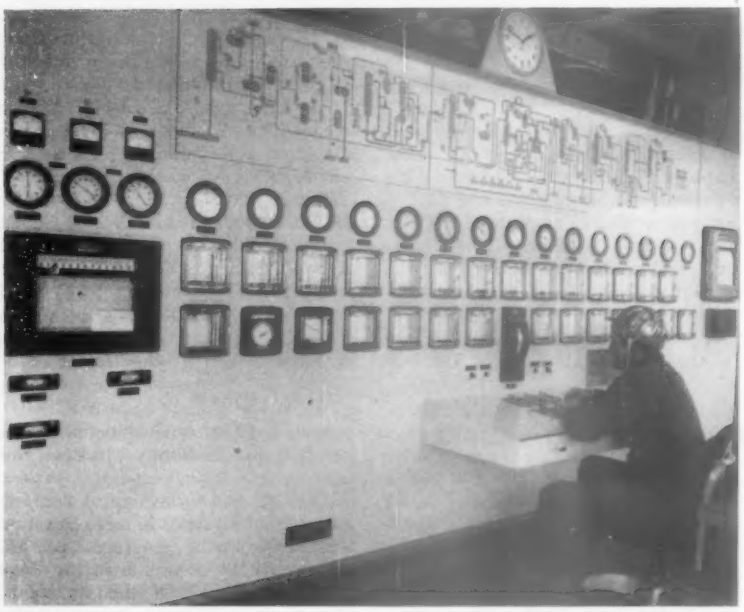
Current production of 15,000 bbl. daily will double by the end of the year, and is scheduled to increase to 50,000 bbl. daily by the end of 1961. All of this oil is moving to foreign markets. In an effort to keep production costs competitive and to expand output, a 12 in. crude pipeline and a new terminal at Bonny will open this year.

Shell-BP has turned up at least six commercial oil fields in an exploration and development program that has cost nearly $175 million in the West African country. Of the six fields, Olibiri, Afam, Bomu, Ebubu, Okoloma, and Elelenwa, Bomu is the biggest producer with an output of more than 8,000 bbl. daily.



GAS-TURBINE-POWERED GENERATORS provide all power requirements for Sun's new gas-products plant. Hydraulic motor

New Laverne gas-products plant



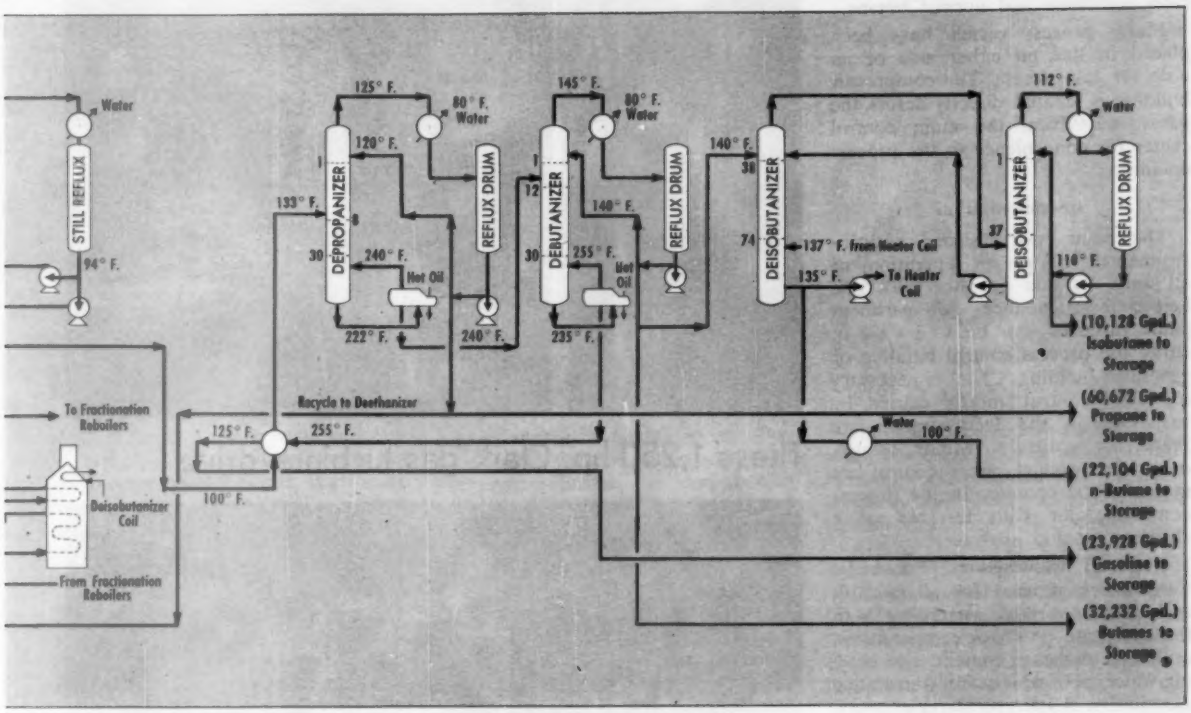
MAIN PROCESS CONTROL PANEL is the heart of the new plant. It is semigraphic. The graphic section is located at the top and includes built-in alarm lights. Control and indicating instruments located below the graphic section control and regulate all variables.

BY WM. T. LAWLER
Sun Oil Co.

THE NEW Laverne gas-products plant located in northwestern Oklahoma is designed to process 150,000 M.c.f. daily of gas-well gas from wells in Laverne field. Field operators provide field separation, deliver and sell separated gas to Michigan-Wisconsin Pipeline Co. at each lease. After all gas has been gathered and brought to a common point, it is delivered to the plant for processing.

The plant features gas-turbine powered generators to provide all the plant's power requirements. Another interesting feature is the hydraulic motor that utilizes pressure drop in the rich-oil stream to drive a lean-oil pump. The plant is instrumented to the extent that only one operator and helper are required for efficient operation.

The plant is designed to operate efficiently at extreme climatic conditions with winterizing protection included where necessary. Other design data are:



drives lean-oil pump, and plant is highly instrumented.

will process 150 M.M.c.f. of gas daily

Extraction process	Chilled oil absorption
Operating pressure	700-900 psi.
Extraction efficiency (100 M.c.f.d.):	
Propane	75%
Butanes	99%
Pentanes & heavier	100%

Dehydration

As gas enters the plant, water is removed in a 96-in.-diameter, 6-tray vertical contactor with a flow of about 20 g.p.m. of triethylene glycol as absorbent. This eliminates hydrate formation when the gas is chilled, and prepares the stream to meet contract specifications. Glycol circulation is provided for the 700-900-psi. differential head by positive-displacement, electric-driven pumps. The glycol regenerator is a conventional atmospheric, direct-fired, horizontal, skid-mounted unit. Instrumentation is provided for completely automatic operation. A water dew-point monitor is located on the process control board to detect a malfunction in the glycol unit.

Liquid Recovery

Chilled oil absorption. Inlet gas is exchanged with outlet gas, then chilled to about 38° F. before entering the absorber. A controlled oil flow of five hundred gallons per minute which has previously been saturated with methane and ethane in the preabsorber section of the reabsorber is chilled to about 37° F. and enters the main absorber.

Hydraulic motor. To reduce power consumption and over-all utility costs, a hydraulic motor with the characteristics of a centrifugal pump is used to pump lean oil to the main absorber. Rich oil from the absorber flows through the motor (connected to a centrifugal lean-oil pump) to the flash section of the reabsorber. Operating at 3,000 r.p.m., it develops about 180 b. hp., sufficient for pumping 250 g.p.m. of absorber lean oil, or about one-half of the total quantity required. A speed-control instrument located on the main control board regulates the quantity of rich oil flowing to the hydraulic motor.

The oil that is not needed for powering the turbine flows through the absorber level control valve. The total stream then flows to the flash section of the reabsorber.

Reabsorber and lean-oil preabsorber. An oil presaturator is built into the top of the reabsorber vessel. Here 150-mole wt. lean oil contacts the reabsorber outlet gas. From the presaturator the oil flows to the reabsorber and main absorber. The vapors flow to the fuel system and to the hydrocarbon dew-point control unit regeneration gas system.

Deethanizer and still. From the reabsorber the rich oil flows to the top of the deethanizer column which performs a stripping function with heat added to both the middle and bottom of the column.

The stabilized rich oil from the deethanizer flows to the lean-oil still. Raw gasoline, which is separated from the oil, flows directly from the still reflux accumulator to the depropanizer.

The product fractionation train is conventional. The first column removes commercial propane. The second separates mixed butane and 12-

lb. R.v.p. gasoline. The third separates isobutane and normal butane.

Major process vessels have been placed in line on either side of an aisle for easy access. The compressor building is located directly across the passageway from the main control center for convenience to the process operator.

Instrumentation

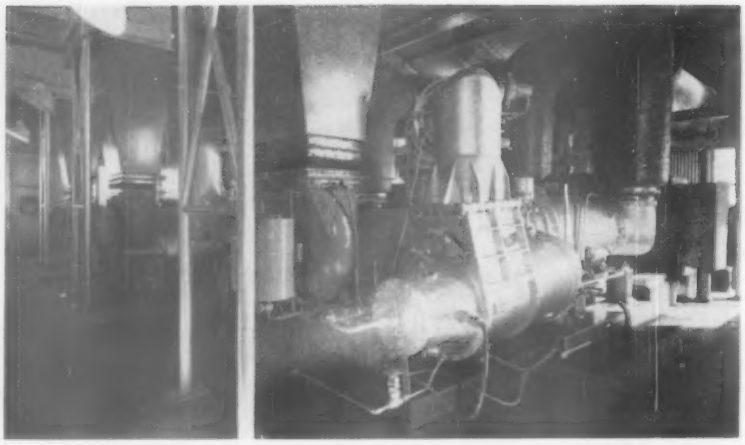
The plant was designed and instrumented to permit operation of all units by one operator with one helper in attendance. All pertinent plant variables can be viewed in either the process control building or generator building. Changes necessary for plant control, mostly caused by variations in the feed stream, are made automatically. Minor adjustments for product purity control are made by the operator in the process control center with the aid of a chromatographic analyzer.

Signal transmission. Pneumatic transmission is used for all controls and process-variable recording with the exception of check temperatures, outlet-gas moisture content, and cooling-water pH, which are transmitted electrically. All temperature, pressure, and flow receiver-recorders are 4-in. strip-chart-miniature type with integral controllers. Level indicators are board-mounted 4½-in.-dial type 3-15-lb. pneumatic devices receiving a signal from caged-type pilot liquid-level transmitters. These transmitters also furnish a signal to the level controllers.

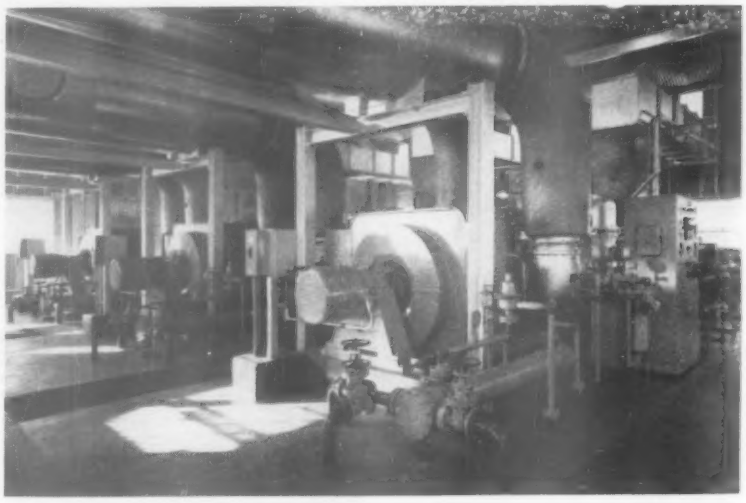
Control panel. The main control panel is semigraphic. The graphic section is located at the top and includes built-in alarm lights. Alarms are included for the most important process variables to detect malfunctions such as high or low levels in vessels located remote to main process area, furnace low-oil flow, furnace highstack temperature, generator failure, and compressor failure.

Control and indicating instruments located below the graphic section control and continuously record all variables. Also located here is a 12-point temperature recorder and a 72-point temperature indicator to monitor additional temperatures. Plant operators are able to detect changes in product purity within a few minutes with the strip-chart temperature recorder and the process chromatograph. Uniform depropanizer and debutanizer fractionation is obtained by instrumentation which adds heat to the bottom of the columns at a set rate and controls the top-section temperature by varying the reflux quantity. The deisobutanizer is controlled by setting the reflux rate and automatically adjusting the temperature on tray No. 34 with reboiler heat.

Volume, specific gravity, and calorific value of the inlet gas, outlet gas, and fuel gas are measured. The calorific value for liquid products and slop oil is computed mathematically from production volumes.



These 1,250-hp. Clark gas turbines drive . . .



these 1,000-kw. generators

THE THREE 6,000-R.P.M. TURBINES equipped with integral speed reduction are connected with the three 1,200-r.p.m. generators. Large pumps and compressor drivers operate on the generator's 2,400 volts, while voltage is reduced to 400 for other major drivers and the mercury-vapor flood lights.

Power Supply

Gas-turbine power generation. Three 1,250 hp. 6,000 r.p.m. turbines with integral speed reduction are connected to 1,000-kw. 2,400-volt, 3-phase, 60-cycle, 1,200-r.p.m. generators. No transformers are used on the power supplied to the large oil pumps and refrigeration compressor drivers. The voltage is reduced to 400 volts for other major power drivers and the mercury-vapor flood lights.

The hot turbine exhaust gases at about 850° F., being rich in oxygen, flow directly to the process heater for use as combustion air to improve the over-all power and heat-generation efficiency. Each of the three turbines has its own duct with automatically operated three-way valves to direct the exhaust gas flow either to the heater or to atmosphere.

It was this idea that the Laverne plant design engineers used to reduce the fuel gas required to approximately 1.6% of the plant throughput of 100 M.M.c.f.d.

The turbines have a semiautomatic startup control system with safety devices and electrical interlocks for protection.

Heating

No steam heat is used. Building heat is provided by gas heaters. All process heating is furnished by four horizontal coils in the process heater designed to use gas-turbine exhaust vapors for combustion oxygen with auxiliary firing. The four coils furnish heat for these uses:

1. Lean-oil-still reboiler.
2. Hydrocarbon adsorption reactivation gas.
3. Heating oil.
4. Deisobutanizer reboiler.

Fourteen burners, using no external air, furnish heat necessary over and above that in the gas-turbine exhaust. Electric ignitors are used to light the burners. Fuel gas is automatically regulated with a still reboiler coil outlet temperature controller located on the process control board. High stack temperature, low oil flow, and flame shutdown devices protect the heater.

Refrigeration System

The chilled temperature level is 37° F. This requires a refrigerant temperature of about 30° F. and one-stage compression with propane refrigerant. Propane product is used for makeup.

The inlet-gas, lean-oil, and reabsorber-gas chillers are all located together underneath a refrigerant flash drum. Refrigerant, controlled by level control, enters the flash drum and flows to the chillers by gravity as needed. Vaporized propane flows directly to reciprocal-type refrigerant compressors. After compression the propane is condensed by water cooling. This is a simple and economical cycle which requires little attention except routine compressor maintenance.

The two refrigerant compressors are balanced—opposed horizontal units driven by 500-hp. electric motors. Two of the four cylinders on each unit are refrigerant cylinders and the other two are used for recompressor service. Both the refrigerant and recompressor suction pressures are controlled by automatic valve lifters.

Hydrocarbon Dew Point Unit

The trace of lean oil present in the outlet-gas stream must be removed to meet contract requirements of 20° F. hydrocarbon dew point or less. This is required to prevent any liquefaction in pipelines operating in colder climates.

A solid-desiccant heavy-liquids-removal unit, consisting of two 78-in.-diameter adsorption towers filled with 4 ft. of silica gel and activated carbon, is used for this purpose. An 8-hour automatically switched cycle is obtained with an electric timer and powered block valves for both main gas and regeneration gas flow. The regeneration gas is heated in an alloy tube coil in the convection section of the process heater and cooled with aerial coolers. Condensed liquids are returned to the lean-oil system.

TABLE 1—PROCESS DATA

Stream		Inlet gas	Outlet gas	Propane	I-butane	Mixed butane	12-lb. gasoline
Pressure—psi.		700-900	675-975	.....	.....	.....	.....
Temperature °F.		93	100	112	110	100	125
Quantity: M.M.c.f.d.		100	95.1	.....	.....	.....	.....
Gal. per day		.....	.....	60,672	10,128	22,104	23,928
Comopsition Mole %	N_2	2.79	2.93	....	....	....	....
	CO_2	0.22	0.22	....	....	....	....
	C_1	86.62	90.00	....	....	....	....
	C_2	5.98	6.17	2.95	....	....	....
	C_3	2.74	0.68	95.15	2.05	....	....
	IC_4	0.33	....	1.24	95.03	0.78	0.30
	NC_4	0.73	....	0.66	2.92	97.25	4.95
	IC_5	0.16	....	....	....	1.83	23.88
	NC_5	0.13	....	....	....	0.14	21.32
	C_6	0.18	....	....	....	....	29.73
	C_7+	0.12	....	....	....	....	19.82
		100.00	100.00	100.00	100.00	100.00	100.00

Cooling-Water System

An induced-draft water-cooling tower is used for heat dissipation from process coolers. Circulation is 4,500 g.p.m. with a 20° F. temperature differential.

Makeup water is supplied from wells in the area equipped with pumps to supply water to a 5,000-bbl. raw-water storage tank. Service water pumps transfer water from this tank for cooling water makeup and plant water systems.

Cooling-water treatment consists of adding a metallic phosphate formula internally for corrosion and scale inhibition, sulfuric acid for alkalinity control, and chlorine for algae and slime control. Phosphate and sulfuric acid are fed continuously with chemical-injection pumps controlled with a timer that automatically sets the rate of treatment in proportion to the rate of makeup water used. The same ratio type of control is used for cooling-tower blowdown. Chlorine is added intermittently once each week by a clock timer set to inject a predetermined quantity.

All plant water coolers are equipped with zinc anodes for corrosion protection.

Storage and Loading

All product storage is composed of horizontal tanks sufficient to store five days production. Storage is also provided for lean oil, slop oil, glycol, and sulfuric acid.

Products can be moved by tank cars, tank trucks, or pipeline. A platform motor-truck scale is used for LPG sales. A rotameter-type automatic blending system is used for dispensing LPG products to obtain any mixture desired.

The tank-car loading rack has 12 spots where cars can be loaded simultaneously with the same or different products. All loading pumps can be started or stopped at loading areas.

Emergency Equipment

Two manual pneumatically actuated shutdown systems have been provided for emergency use. When actuated at either of six promient locations within the plant area, one system:

1. Closes plant inlet and outlet block valves.
2. Stops all pumps, compressors, and electric devices except hot-oil circulating pumps, water-circulating pumps, instrument air compressors, cooling-tower fans, and lights.
3. Bleeds air from process area instrument air system to move control valves to safe position.
4. Cuts furnace fires.
5. Diverts gas-turbine exhaust gas to atmosphere.

The second system, when actuated:

1. Performs all five functions listed above.
2. Stops gas-turbine-driven generators.
3. Starts gas-engine-driven fire pump and 5-kw. emergency generator.

The fire-fighting system consists of two fire pumps, one electric driven, the other gas driven, both with a capacity of 500 g.p.m. at 125 psi. The gas-driven pump is started automatically when generators are shut down during an emergency. Fire hydrants are spaced conveniently throughout the plant area. Permanent water monitor nozzles are provided adjacent to the process area so that water can be directed, unmanned, to any section by positioning the nozzles. Water spray nozzles are provided for all product storage tanks.

Dry-chemical carts are located convenient to all hazardous areas along with water hose carts. One or more dry-chemical hand fire extinguishers have been placed in all buildings.

We still don't know much about

Effect of bit weight on drilling rate

. . . but we're learning. Some of our empirical approaches serve well. Study is needed.

BY PRESTON L. MOORE
University of Oklahoma
and
CARL GATLIN
University of Texas

IT IS DISTURBING to realize that after 100 years of oil-well drilling, we still have no complete theory by which we can formulate even the effect of bit weight on drilling rate.

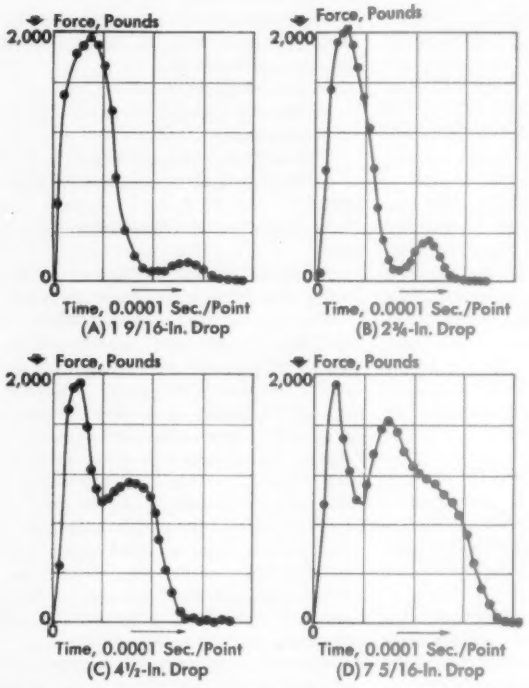
This is excusable, perhaps, because the problem is quite complex. Still, here is one of the most promising areas for future basic drilling research: a complete investigation into how we can remove more rock from the bottom of the hole for each unit of energy we put into it.

We are today trying to write equations which will tell us how to vary weight on bit over the length of the bit run so that we minimize cost.[1] In doing this, we are hampered by incomplete information; in some cases we have only half-true approximations.

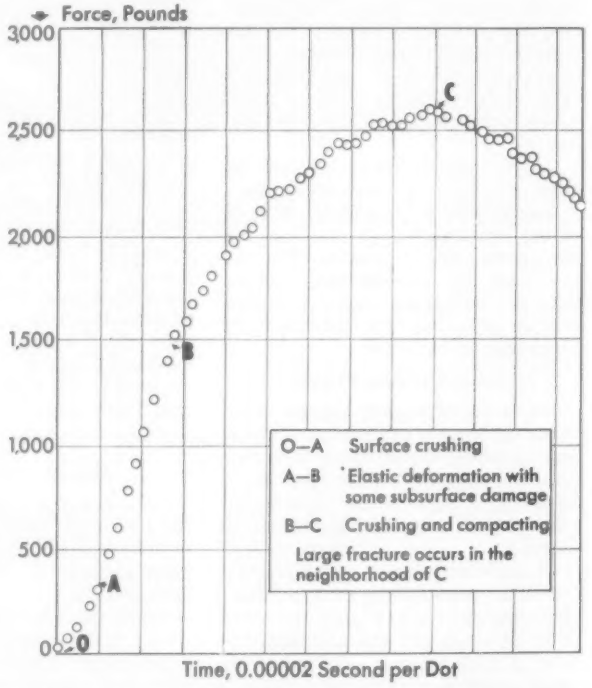
Now, we rely on empirical approaches. Some of these have served well; an example is Speer's analysis and compiling of field data.[2] But, we will not have truly optimum drilling conditions until we have exact and complete information on such things as how bit weight affects drilling rate.

In this article, we will examine the work already done by others to establish how instantaneous drilling rate varies with bit weight. We will discuss only "instantaneous" drilling rate; such factors as bearing and tooth wear are omitted. Nor will we treat the possibility of varying weight over the life of the bit. Later installments of this series will discuss effect of bit weight on over-all penetration rate.

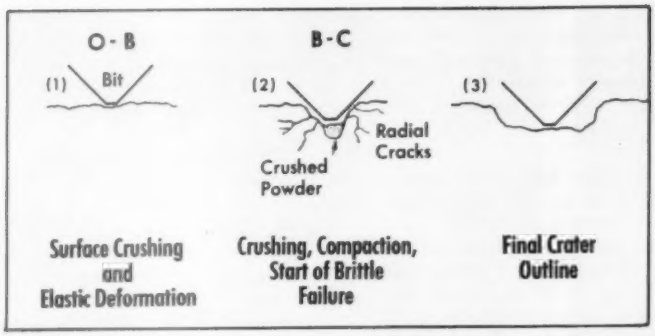
Much of the important work has been done on "brittle" rocks at atmospheric pressure. As such, it applies directly to percussion (cable-tool) drilling in such rocks. Rocks which are brittle at atmospheric conditions, however, may become quite ductile at high confining pressures like those deep in the earth.



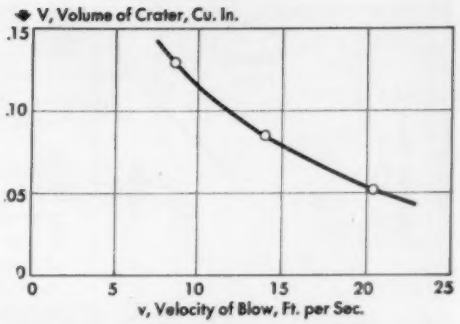
TYPICAL FORCE-TIME CHARTS for a 15-lb., 0.03-in. bit dropped on Indiana limestone. Each chart (called a force waveform) is for a different drop height. (After Pennington.) Fig. 1.



ENLARGED FORCE WAVEFORM from Fig. 1. For illustration of the crushing, elastic deformation, crushing and compacting, see Fig. 3. Fig. 2.



SEQUENCE OF EVENTS when a blunt, wedge-shaped bit strikes a brittle rock. The letters O-B and B-C refer to the regions on the curve in Fig. 2. (Redrawn from Hartman.) Fig. 3.



ENERGY OF THE BLOW was held constant at 22.2 ft. lb. in this test. Velocity was varied. Bit was a 30° wedge; rock was synthetic. Fig. 5.

Still, there are enough basic similarities between percussion drilling and rotary drilling to make the brittle rock studies important.

Drilling "Brittle" Rock

Drilling Research, Inc. (DRI), contributed a major part of the information about brittle rock;[3] Hartman did further work.[4] They studied how impact blows by various penetrators caused rock fragmentation to vary with such factors as:

1. Energy of the impact or blow.
2. Tooth (penetrator) shape.
3. Indexing of the tooth.
4. Velocity of the blow.

In these tests, a weighted bit was dropped from various heights, striking a specimen of rock below. Strain gages were attached close to the bit tooth; readings from these were recorded into force-time curves (called force waveforms). The shape and size of the crater formed by the impact was also studied.

Fig. 1 shows four of DRI's typical waveforms; they have several significant features. Notice that the maximum force developed (about 2,000 lb. in Fig. 1) does not vary much with the height from which the bit was dropped. This height, of course, is a measure of the energy. This energy governed only the number of failure cycles. For example, note the buildup of the second peak in the last three curves. Failure followed a cyclic pattern of force buildup, failure, buildup, failure, etc.

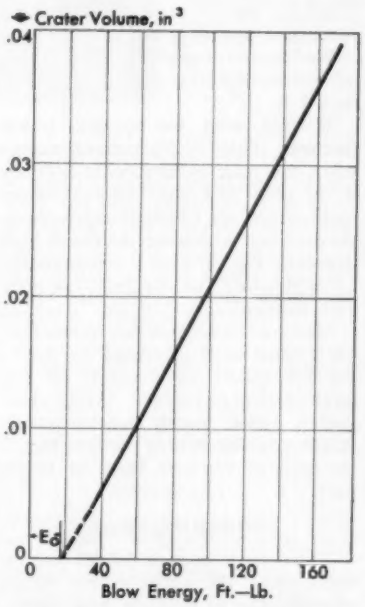
Notice also that waveforms of the second and ensuing buildups are not so regular as the first. Perhaps this is because of unremoved cuttings formed by the first failure cycle.

Fig. 2 shows one of the waveforms expanded; we can use it to see how failure occurs. Note the points O, A, B, and C on the figure. From O to A, we can attribute this initial force to surface crushing. From A to B is the region of elastic deformation. B to C shows crushing and compaction. Finally, at C, there is brittle failure; this failure is rather explosive, with fracturing and chipping as a consequence.

Fig. 3 shows all these things schematically.

Waveform lessons. From these studies of brittle failure, we are led to a general conclusion: The basic variable of percussive drilling is the energy of the blow struck. Basis for this conclusion is in measuring the amount of rock removed by the bit at various blow energies (dropped from various heights).

Fig. 4 supports this conclusion; as it shows, the volume of rock removed depends directly on the blow energy. As a result of data similar to Fig. 4,



BIT VELOCITY was held constant at 14 ft. per second in this test. There is a straight-line relation between crater volume and energy of blow. Bit was a 90° sharp wedge. (Redrawn from Hartman.) Fig. 4.

some propose that we can calculate the crater volume (the amount of rock removed per blow) in this manner:

$$V = a\ (E - E_o) \qquad (1)$$

Or, when E is much greater than E_o, V is approximately equal aE where:

V is crater volume.

E is drop energy.

E_o is threshold energy level which must be exceeded before there is appreciable damage to the rock.

a is slope of plot of V vs. $(E - E_o)$. In a given case, this is a constant depending on rock, shape of bit tooth, and perhaps other variables.

We could also state Equation 1 in this way:

$$V = A + aE \qquad (2)$$

where A is equal $-aE_o$ and is the intercept of a plot of V vs. E.

The disturbing thing about Equation 1 is that it doesn't account for any possible effects of blow velocity at constant energy. There is some conflict about such effects: In DRI results, the effect was negligible; in Hartman's data which covered a larger range of velocity, the effect was appreciable. Actually, none of the data cover a velocity range wide enough to prove either viewpoint definitely.

However, we must note Fig. 5 which shows Hartman's results; he says crater volume can be expressed thus at constant energy:

$$v = B/v \qquad (3)$$

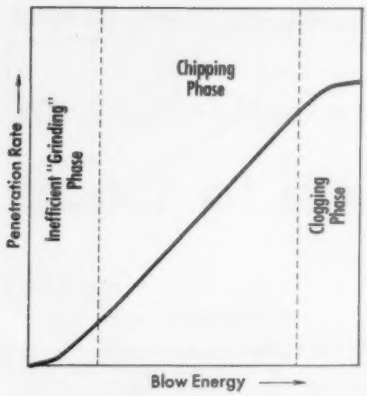
B is some constant and v is impact velocity.

Recall that the change of momentum of a small body striking an "immovable" object is:

$$M = m\ (v - v_1) = \int_o^{te} F\ dt \qquad (4)$$

where:

M is change in momentum of the mass m.



PERCUSSIVE DRILL (like cable tools) generally performs like this. The upper limit of the chipping region is set by the efficiency of removing cuttings; this is similar to "foundering" of a roller bit. Fig. 6.

m is mass of the small object.

v is initial velocity of the small body (vector).

v_1 is final velocity.

$$\int_0^{tc} F\,dt$$

is impulse or area under force-time curve.

t_c is contact time over which F acts.

If we let v_1 be zero (no rebound) and m be the mass of the striking bit, we may write Equation 4 in this way:

$$M = mv = \int_0^{tc} F\,dt \qquad (5)$$

We know that the kinetic energy of the falling bit, E, is equal $\frac{1}{2}mv^2$. So, it is apparent that the momentum M and the energy E are related:

$$M = 2E/v \qquad (6)$$

Now, let us compare Equations 3 and 6. From them, we could expect that the amount of rock removed (volume of the crater) would go down as the velocity of the blow goes up (at constant energy). That is, the declining curve in Fig. 5 is precisely what we would expect if crater volume were dependent on blow momentum rather than on blow energy.

Note also Fig. 4 which shows V to be directly proportional to $(E - E_o)$, or linear with E. Since both E and v are constant, we could get the same linearity by plotting crater volume against momentum; that is, plotting V vs. M. See Equation 6.

Thus, it appears possible that the basic variable is momentum rather than energy. This is, however, uncertain since there are no data over a wide range of blow velocity. It is interesting that this same argument exists in jet-bit hydraulics. Some feel that bit horsepower (energy) is the important variable; others say impact force (momentum) is the basic criterion.

Relate to roller bits. In percussive drilling of brittle rocks at atmospheric pressure (as with cable tools), penetration rate follows the same pattern of crater volume vs. blow energy that we show in Fig. 4. There is, however, an upper limit for E; this is where the bit becomes "clogged" as Fig. 6 shows. This upper limit is drawn by the method of removing cuttings; it is like the "foundering" in roller-bit drilling.

Fig. 3 of the previous article in this series (April 11), shows a similar pattern for the effect of bit weight on penetration rate of rock bits. Hence, we can conclude that there is at least a basic similarity between the processes.

Fig. 7 is a sequence of high-speed photographs taken by Hughes Tool Co.[5] From these pictures, it appears that the momentary loading on a tool is similar to percussive drilling. However, blow velocity is quite low. Although total weight on bit is constant, alternate loading and unloading of the various teeth is much the same as in percussive drilling.

Depending on the particular bit (cone offset, etc.) the tooth may also have a horizontal velocity during the cycle. This means, of course, that the roller bit may have features of both percussive and drag bits.

We restrict ourselves here to the percussive features; that is, to hard-rock bits.

To this point, we assumed brittle fracture. This type failure occurs when the rock behaves elastically up to the point of failure. Now, consider rocks which are brittle at atmospheric pressure but which are ductile at high pressure. Fig. 8 shows this apparent "strengthening" of the rocks as pressure increases.

Many of the questions about ductile failure were answered by applying the theory of plasticity to bit-tooth penetration.[6,7] While these studies added greatly to our understanding of the drilling process, there's no need to examine them at length here.

Writing Equations

There have been a lot of suggestions about the equation we should properly use to describe how instantaneous peneration rate is determined by bit weight. One frequently suggested form is this:

$$R_p = cW^b \qquad (7)$$

where:

R_p is penetration rate.

c is some constant.

W is weight on bit, greater than zero but less than the foundering weight.

b is an exponent varying from 1 for soft rocks to around 2.3 for hard rocks.

On the other hand, we may also represent many drilling curves by two straight lines of different slope.[8] Such a procedure is in line with Equation 1 which was developed from the drop-tester studies. That is, R_p changes abruptly above some critical load. This critical load corresponds to the transition from a grinding or crushing action to a chipping action.

Thus, we are lead to a simple linear relation:

$$R_p = d + eW \qquad (8)$$

where:

W is less than the foundering weight but greater than the critical load that causes chipping.

d is intercept of plot.

e is slope of plot.

The equivalent of our Equation 8 is:

where:

$$R_p \text{ is } f(W - W_c) \qquad (9)$$

$-fW_c$ is $= d$, intercept of plot.

W_c is critical load that causes chipping.

For soft rocks, d is approximately zero. Thus, Equation 8 is equivalent to Equation 7 when b is equal one. This is the form used by Speer in his analysis.[2]

Simon proposed another equation based on the DRI studies. For a constant and rotary speed and a given bit size, the equation is:

$$R_p = kW/S \qquad (10)$$

where:

k is a constant.

S is the "drilling strength" of the rock.

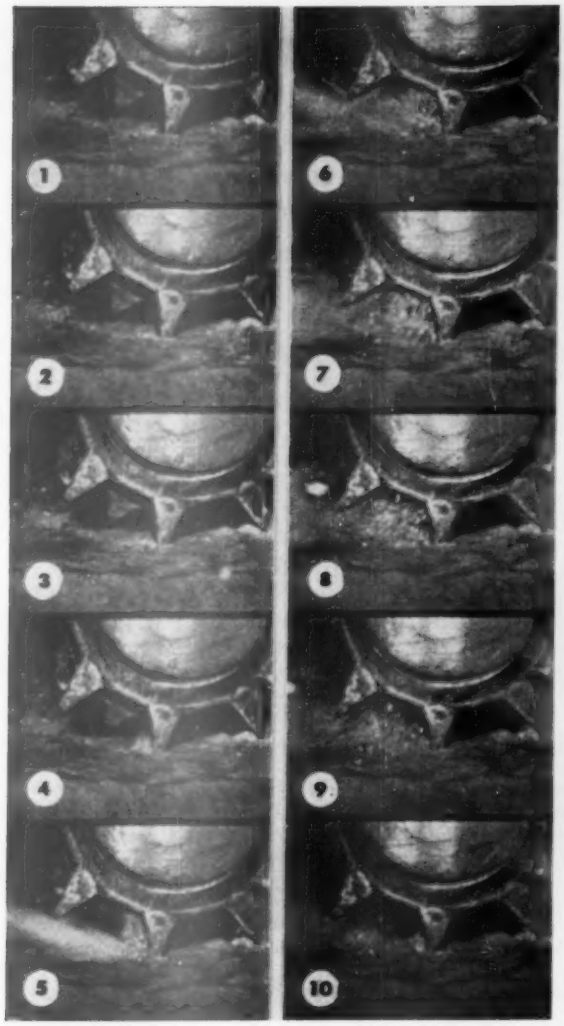
Simon defined the drilling strength as the ratio of the energy input to the rock to the volume of rock broken out by a 90°-wedge-angle tooth under a vertical impact loading.

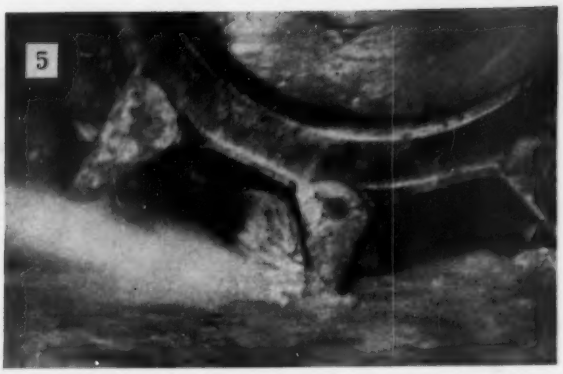
We have another equation suggested for finding rate of penetration in the normal drilling range. This is from Outmans' theoretical analysis:

$$R_p = G\,[(1 + HW)^{1/2} - 1]^2 \qquad (11)$$

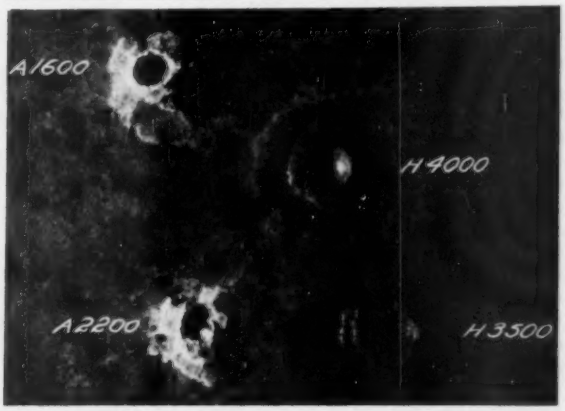
Here, G and H are rather involved constants; they are obtained from two data points on the drilling-rate curve.

Thus, it is a puzzle as to which





HIGH-SPEED PHOTOS of bit drilling rock at atmospheric pressure; cuttings are blown away by air. Starting at 1, bit tooth puts increasing pressure on rock till it reaches fracture point at 5 (shown enlarged above). By 10, the fracturing failure has diminished and ceased. Fig. 7.



ROCKS FAIL DIFFERENTLY at atmospheric pressure from the way they do at the higher pressures that exist on the bottom of a well. The letters A show failure at atmospheric pressure; letters H show failure at 5,000 psi. Numbers show the load on the "bit tooth." (After Payne and Chippendale.) Fig. 8.

approach is most practical in any particular case. None is a panacea. For field engineering, we must still rely on the empirical approach. But, the equations above do serve as guides in making further approaches to the basic problem.

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NOTE—Other articles in this series ran as follows: Part 1—February 8, 1960; Part 2—February 29, 1960; Part 3—April 11, 1960.

Limited equation of state for gas yields

Simplified pipeline-flow formula

Suitable for routine algebraic solution, this formula is the result of integration of a compressibility correction factor along with the other variables in the basic differential equation. Simplification is possible because only temperatures and pressures common to pipeline operating conditions are considered.

BY W. L. DUCKER

. . . head since 1948 of the department of petroleum engineering at Texas Technological College. He has had varied experience in the oil fields as well as in the equipment phase of the industry. His gas-pipeline experience dates back to the early 1930's when he was doing engineering work for Consolidated Gas Service Corp. The idea of developing a simplified gas-flow formula was implanted during this assignment, and this article is the result of several years of study. Ducker is a graduate of Oklahoma University.

IT IS THE PRACTICE in the gas-pipeline industry to make periodic flow tests on sections of the major transmission lines. From the data yielded by these tests a value of E, the efficiency factor, is calculated as an index of line performance. Although E is supposed to be a function of pipe roughness only, and in liquid free lines would be expected to decrease with time, the opposite effect—indicating the pipe becoming smoother—has been observed so frequently as to raise doubts as to the complete validity of present gas-pipeline flow formulas.

This erratic failure to predict performance could in part be due to a mathematical defect in the derivation of the general flow formula from which all gas-pipeline formulas are derived. The derivation[1] employs the equation of state of an **Ideal** gas in the differential equation of flow and the compressibility factor, Z, is inserted after integration.

The error here is that Z itself is a function of pressure and to be correct should be carried through the integration as a variable.

Such a course would, however, require that an equation of state of the real gas be incorporated in the differential equation. The prospects of integrating a differential expression that contained any one of the presently accepted equations of state of hydrocarbon gases are sufficiently grim to more than justify the past practice.

One of the worst features of the above procedure is that there is no reliable indication of where in the integrated flow formula the Z or the Z's belong, with the result that various positions have been proposed, tried, and discarded for others, when they did not seem to work well.

This paper is based on work done by the author under the Texas Technological College Petroleum Research Program sponsored by the Petroleum Advisory committee and the petroleum industry.

For example, it first was noted that if Z's were to be associated with the pressure terms in the flow formula, the expression

$$P/Z = NRT/V \qquad (1)$$

might apply, so it was therefore reasoned that the pressure term should be of the form:

$$(P_1/Z_1)^2 - (P_2/Z_2)^2 \qquad (2)$$

Where:

Z_1 is based on P_1.
Z_2 is based on P_2.

This did not work well, found little or no use, and gave way to:

$$P_1^2/Z_1 - P_2^2/Z_2 \qquad (3)$$

which in turn was replaced by either:

$$\frac{P_1^2 - P_2^2}{(Z_1 + Z_2)/2} \text{ or } \frac{P_1^2 - P_2^2}{Z_m} \qquad (4)$$

Where:
Z_m is based on $(P_1 + P_2)/2$.

It is the current consensus that the best form is:

$$\frac{P_1^2 - P_2^2}{Z_m} \qquad (5)$$

Where:
Z_m is based on P_a; the average line pressure, and

$$P_a = 2/3\,[P_1 + P_2^2/(P_1 + P_2)] \qquad (6)$$

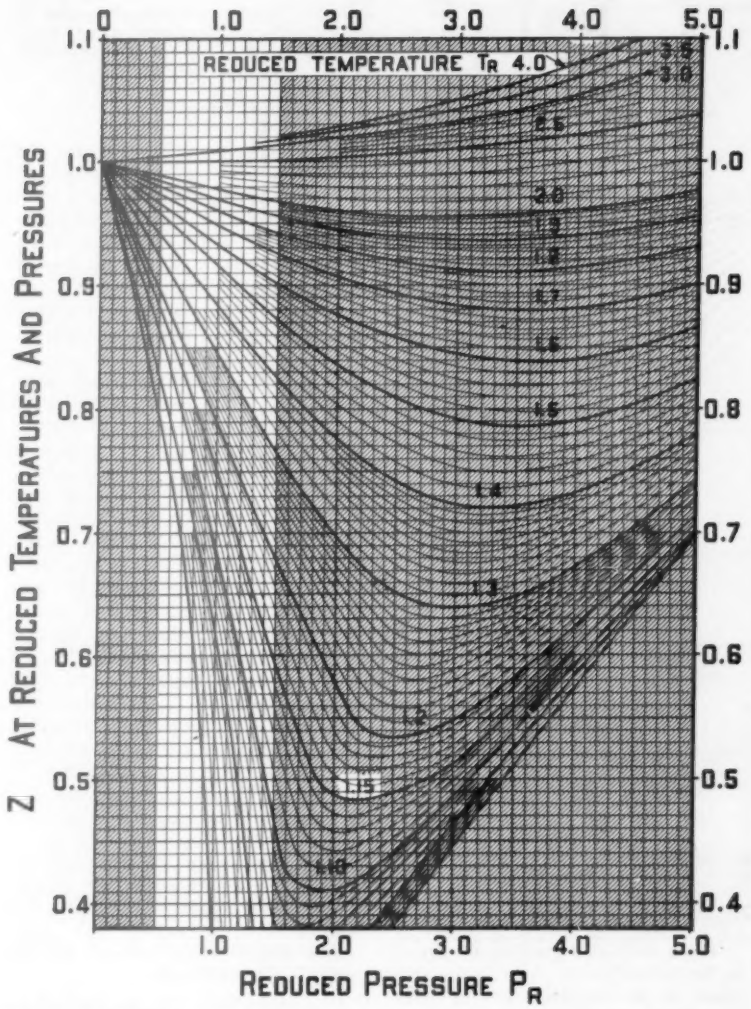
It is the purpose of this article to develop a limited equation of state for hydrocarbon gases that will be as accurate as published PV data over the limited range of operating conditions of natural-gas-transmission lines and which can be incorporated in the differential expression of flow in a manner that will permit integration.

Thus integrated the resulting general formula will give pipeline-flow formulas that are algebraic rather than transcendental and which will (1) permit direct solution for the value of any one of the several variables, (2) obviate the necessity of determining reduced pressures and temperatures, and Z-values in order to calculate flow, and (3) give a mathematically rational answer to the question of which, if any, of the various methods of applying Z in the integrated flow formula was the correct one.

Procedure

Natural-gas-transmission lines operate at conditions such that:

$$0.50 < P_R < 1.50 \qquad (7)$$



IN THE UNSHADED PORTION of the Z factor chart, the T_R isotherms above $T_R = 1.15$ are approximately linear. Fig. 1.

It may be noted in Fig. 1, in the unshaded area representing the above range, that the reduced temperature isotherms above $T_R = 1.15$ are approximately linear. Also for hydrocarbon gases within the gravity range:

$$0.55 < G < 1.00 \qquad (8)$$

The pseudocritical pressures and temperatures are substantially linear functions[2] of gravity, as follows:

$$P_{PC} = 690 - 31\ G \qquad (9)$$

$$T_{PC} = 158 + 1{,}000\ G/3 \qquad (10)$$

These expressions give results that agree with published[3] values within an error or less than 0.10%, which is less than the scattering of the original empirical values.[4]

These linear relationships suggest a fairly simple equation of state, if limited to the range of operating conditions of natural-gas-transmission lines.

In order to examine the range of reduced temperatures that should be considered in this study, the relationship between flowing temperature, gas gravity, and reduced temperature was plotted as shown in Fig. 2. An examination of those data indicates that a range of reduced temperatures

$$1.24 < T_R < 1.48 \qquad (11)$$

and gas gravities

$$0.55 < G < 0.75 \qquad (12)$$

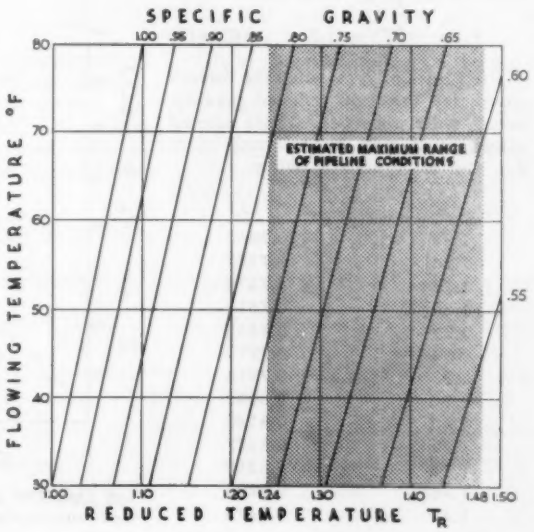
would cover the range of transmission line gas likely to be encountered in practice.

Using this range of reduced temperatures, a large scale P_R vs. Z plot was made of the reduced temperature isotherms by steps of 0.02 units and over the range of reduced pressures $0.55 < P_R < 1.50$ using the California Natural Gasoline Association F_{PV} data.[3] That plot was similar to the one shown in Fig. 3.

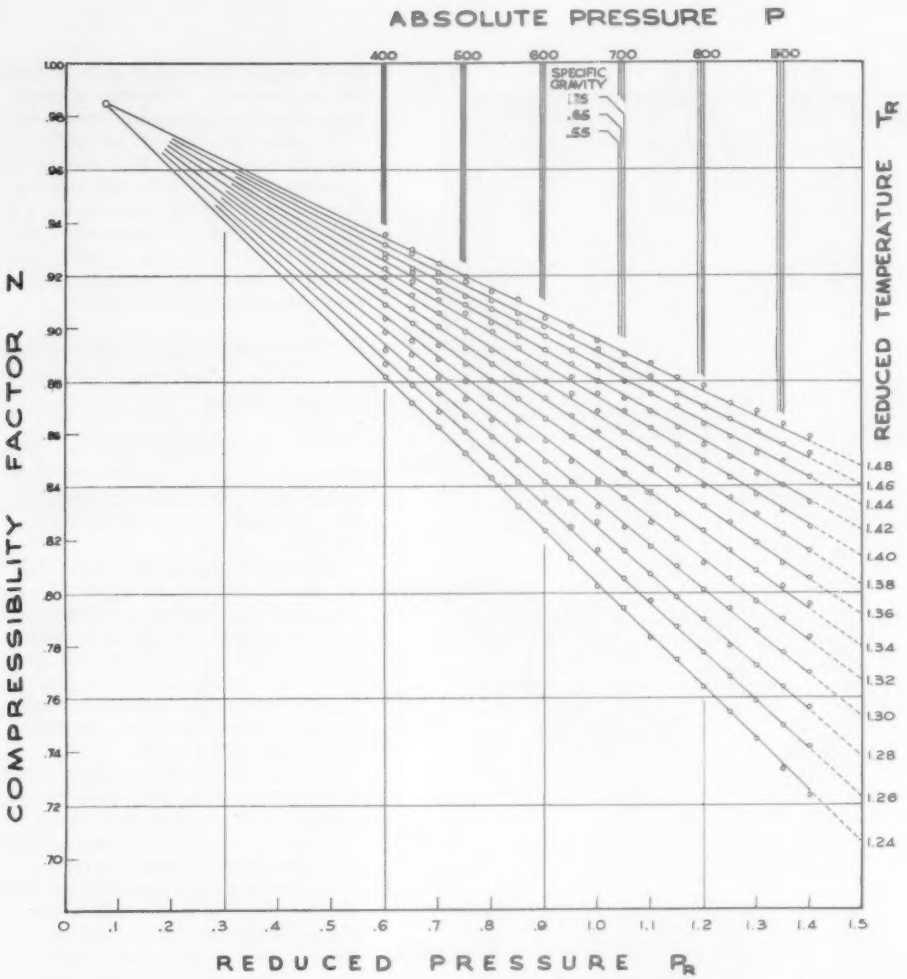
In order to lay converging straight lines through the plotted data points, threads were attached to a weighted but movable "convergence point" while the threads themselves were carried over the edge of the drafting table and weighted at their ends. Thus it was possible to move a convergence point as well as the individual threads until a "best line" was had through each set of data over the reduced pressure range:

$$0.60 < P_R < 1.40 \qquad (13)$$

These limits correspond to the absolute pressure range of 400 to 900



SHADED PORTION of this plot shows the conditions of temperature, reduced temperature, and gas gravity that would probably be encountered in pipeline operations. Fig. 2.



THE LIMITED range of reduced temperature from Fig. 2 was used in this plot of reduced pressures versus compressibility factors. Fig. 3.

psia. for hydrocarbon gases in the gravity range:

$$0.55 < G < 0.75 \quad (14)$$

When the best possible alignment of the threads through the data points was achieved, the coordinates of the convergence point were found to be

$$P_R = 0.075 \text{ and } Z = 0.985 \quad (15)$$

The values of Z at which the threads intersected the 1.50 reduced pressure isobar were recorded. These special values of Z will be referred to as $Z_{1.5}$ and are tabulated below.

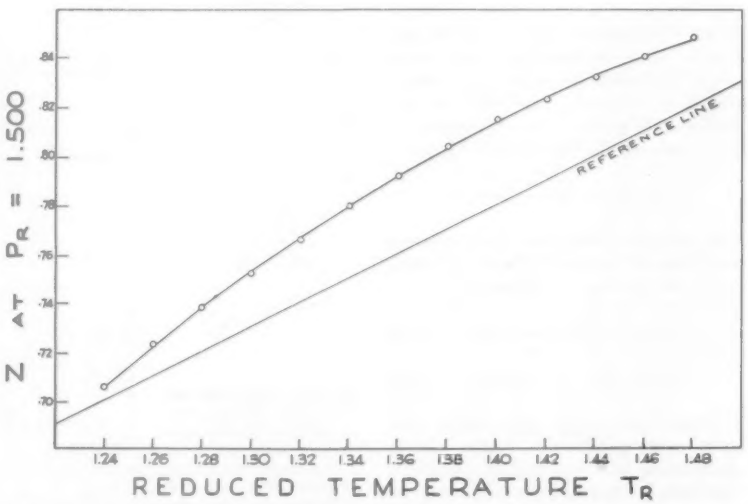
T_R	$Z_{1.5}$
1.24	0.7055
1.26	0.7227
1.28	0.7378
1.30	0.7516
1.32	0.7655
1.34	0.7791
1.36	0.7916
1.38	0.8035
1.40	0.8145
1.42	0.8227
1.44	0.8318
1.46	0.8400
1.48	0.8478

These data are plotted in Fig. 4 as the circled points. Also on the same figure is plotted the arbitrary reference line:

$$Z_{1.5} = 0.50\ T_R + 0.08 \quad (16)$$

Conventional methods of analysis yielded the expression:

$$Z_{1.5} = 0.872680 - 1.075\ (1.63435 - T_R)^2 \quad (17)$$



THE SMOOTH CURVE is a plot of Equation 17. The reference line is present so that magnitude of errors can be studied. Fig. 4.

as being the most probable relationship between the T_R and the $Z_{1.5}$ data tabulated above. The values of $Z_{1.5}$ calculated from Equation 17 are plotted as the smooth curve in Fig. 4.

Since the differences between the raw and the smoothed data in Fig. 4 are too small to give any useful estimate of the quality of the curve, the values of $Z_{1.5}$ above the arbitrary reference line are plotted as the upper portion of Fig. 5 which effectively spreads the vertical scale and shows to better advantage the degree of correspondence between the raw data and the plot of Equation 17.

On the lower portion of Fig. 5 is a plot of the residuals or the differences between the raw data points and the curve. Since the greatest of these residuals is less than 0.001, and since they show no sustained "trend," and since their sum is small (0.00015) the quality of the synthesis is good.

Accepting Equation 17 as being sufficiently supported by the data of Fig. 5, the lines on Fig. 3 were plotted through the convergence point and through $Z_{1.5}$ values calculated from Equation 17 and plotted on the $P_R = 1.50$ isobar. Fig. 3 then represents an idealized compressibility - factor diagram for pipeline gas at transmission-line conditions.

It may be noted on Fig. 3 that the basic data are erratic, especially at the higher values of T_R. Nonetheless, the lines through those points would seem to be as good as any lines that could be drawn through them, and it could well be that data taken from the lines would have a **higher** probability of being correct than data taken from any of the individual points themselves.

In Fig. 3 the slope of any isotherm is:

$$M' = \frac{0.985 - Z_{1.5}}{0.075 - 1.5} \qquad (18)$$

Substituting Equation 17 in Equation 18:

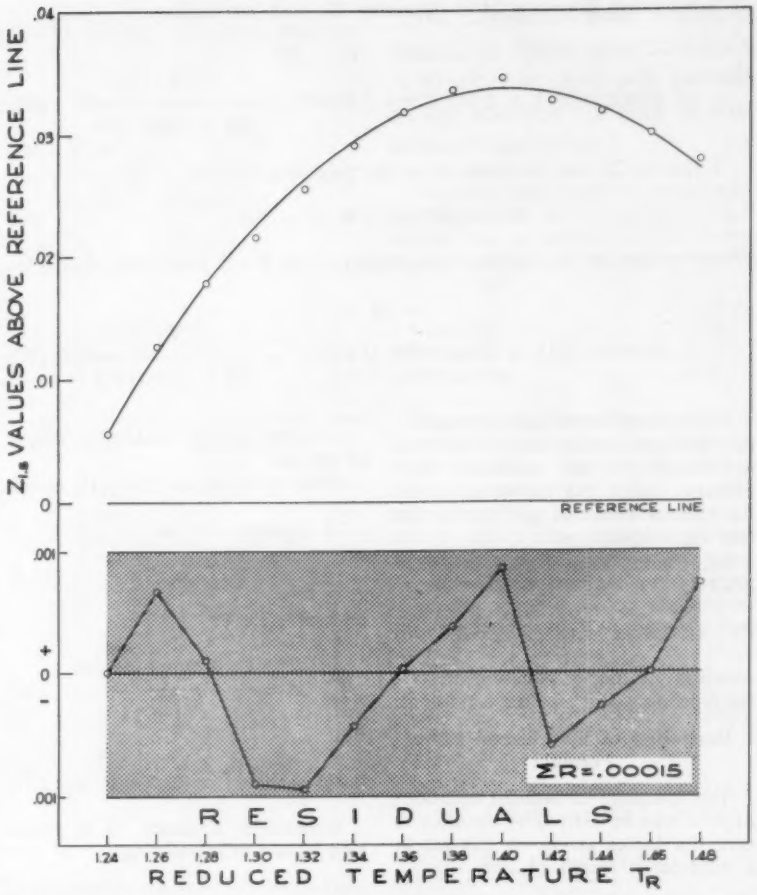
$$M' = -0.078821$$

$$- 0.754386\,(1.63435 - T_R)^2 \qquad (19)$$

Using the convergence point and the slope M' of any T_R isotherm in the point-slope form, a general expression for the compressibility factor, Z, in terms of reduced pressure and reduced temperature is possible.

Point-slope form:

$$Y - Y_1 = M\,(X - X_1) \qquad (20)$$



VALUES of $Z_{1.5}$ plotted above the arbitrary reference line from Fig. 4. Residuals are given in the lower portion of the figure, showing the small error involved in the basic assumptions. Fig. 5.

From Equation 9: $P_{PC} = 690 - 31\,G$.

G	P_{PC}
0.55	673
0.65	670
0.75	667

Since the range of pseudocritical pressures is so small for the range of gas gravities considered in this development, a negligible error would result from taking the mean value of $P_{PC} = 670$ to apply to the full range of gas gravities.

Then:

$$P_R = P/670 \qquad (22)$$

Absolute pressures corresponding to reduced pressures for gas gravities of 0.55, 0.65, and 0.75 are plotted in Fig. 3.

These give an estimate of the error in Z values that would result from assigning a pseudocritical pressure of 670 to all gravities from 0.55 to 0.75. This seems justified since most transmission-line gas has a gravity close to 0.65.

Substituting Equations 15 and 19 in Equation 20 and rearranging:

$$Z = 0.985 - (P_R - 0.075)\,[0.078821 + 0.754386\,(1.63435 - T_R)^2] \qquad (21)$$

Substituting Equation 22 in Equation 21 and rearranging:

$$Z = 0.985 - (P - 50)\,[0.000117643 + 0.00112595\,(1.63435 - T_R)^2] \qquad (23)$$

From Equation 10:

$$T_R = \frac{T}{T_{PC}} = \frac{T}{158 + 1{,}000\,G/3} \qquad (24)$$

Substituting Equation 24 in Equation 23, and rearranging:

$$Z = 0.985 - (P - 50) \times [0.000117643 + 0.00112595\ (1.63435 - \frac{T}{158 + 1{,}000\ G/3})^2] \quad (25)$$

Equation 25 may be reduced to the point-slope form:

$$Z - 0.985 = -M\ (P - 50) \quad (26)$$

Where $-M$ is the slope of the T_R isotherms on the $P - Z$ plane, and is equal to:

$$-M = -[0.000117643 + 0.00112595\ (1.63435 - \frac{T}{158 + 1{,}000\ G/3})^2] \quad (27)$$

M is a function of flowing temperature and gas gravity and is therefore a constant for any particular flow problem. Table 1 gives values of M for various values of gas gravity and flowing temperature.

Substituting Equation 26 in PV = ZNRT:

$$PV = [0.985 - M\ (P - 50)]\ NRT \quad (28)$$

which is the limited equation of state for pipeline gas at pipeline conditions.

Derivation of the General Flow Formula

The following differential equation[5] of flow may be derived by equating to zero the forces acting on the gas in a differential length of line.

$$dP + \frac{2\,f\,V^2}{g\,\nu\,D}\,dL + \frac{V}{g\,\nu}\,dV = 0 \quad (29)$$

Where:

dP is the change of pressure in the differential length of line dL.

D is the diameter of the line.

f is the friction factor of pipeline flow.

V is the velocity of flow.

g is 32.17, the acceleration of gravity.

ν is the specific volume.

L is the length of the line.

All in consistent units.

At this point it has been customary to differentiate:

$$PV = WRT \quad (30)$$

for a value of dP and to substitute that in Equation 29. Instead, the equation of state, 28, will be used in the following form:

$$P\nu = (0.985 - PM + 50\,M)\,RT/\mu \quad (31)$$

Where:

R is the universal gas constant, 1,545.

μ is the average molecular weight of the gas.

Other terms are as previously noted.

In Equation 31, let

$$RT/\mu = C \quad (31.5)$$

and solve for P:

$$P = \frac{C\ (0.985 + 50\ M)}{\nu + CM} \quad (32)$$

But

$$0.985 + 50\ M = b,\ \text{Y-intercept} \quad (33)$$

Substituting Equation 33 in Equation 32 and differentiating:

$$dP = \frac{-\,C\,b\,d\nu}{(\nu + CM)^2} \quad (34)$$

Substituting Equation 34 in Equation 29:

$$\frac{C\,b\,d\nu}{(\nu + CM)^2} - \frac{2\,f\,V^2\,dL}{g\,\nu\,D} - \frac{V\,dV}{g\,\nu} = 0 \quad (35)$$

Now let m be the weight rate of flow and A be the cross-sectional area of the pipe.

Then: $V = \frac{m\,\nu}{A}$

and $V\,dV = \frac{m^2}{A^2}\,\nu\,d\nu \quad (36)$

Substituting Equation 36 in Equation 35, and dividing by ν:

$$\frac{C\,b\,d\nu}{\nu\,(\nu + CM)^2} - \frac{2\,f\,m^2\,dL}{g\,D\,A^2} - \frac{m^2}{g\,A^2}\,\frac{d\nu}{\nu} = 0 \quad (37)$$

From Equation 37:

$$b\,C\int_{\nu_1}^{\nu_2}\frac{d\nu}{\nu\,(\nu + CM)^2} - \frac{m^2}{g\,A^2}\int_{\nu_1}^{\nu_2}\frac{d\nu}{\nu} - \frac{2\,f\,m^2}{g\,D\,A^2}\int_0^L dL = 0 \quad (38)$$

Integrating:

$$\frac{1}{CM}\left[\frac{b\,C}{\nu_2 + CM} - \frac{b\,C}{\nu_1 + CM} - \frac{b}{M}\log\frac{(\nu_2 + CM)/\nu_2}{(\nu_1 + CM)/\nu_1}\right] - \frac{m^2}{g\,A^2}\log\frac{\nu_2}{\nu_1} - \frac{2\,f\,m^2\,L}{g\,D\,A^2} = 0 \quad (39)$$

From Equation 32:

$$\frac{b\,C}{\nu + CM} = P \quad (40)$$

Substituting Equation 40 in Equation 39:

$$\frac{1}{CM}\left(P_1 - P_2 + \frac{b}{M}\log\frac{P_1\,\nu_1}{P_2\,\nu_2}\right) + \frac{m^2}{g\,A^2} \times \left(\frac{2\,f\,L}{D} + \log\frac{\nu_2}{\nu_1}\right) = 0 \quad (41)$$

But $\frac{P_1 v_1}{P_2 v_2} = \frac{Z_1}{Z_2}$ and from Equations 26 and 33 $Z = b - PM$ (42)

Substituting Equation 42 in Equation 41:

$$\frac{1}{CM}\left(P_1 - P_2 + \frac{b}{M}\log\frac{b - P_1 M}{b - P_2 M}\right) + \frac{m^2}{g A^2} \times \left(\frac{2 f L}{D} + \log\frac{v_2}{v_1}\right) = 0 \quad (43)$$

Examining the term:

$$\frac{b}{M}\log\frac{b - P_1 M}{b - P_2 M} \quad (44)$$

	Minimum	Mean	Maximum
b is in the order of	0.992	0.995	0.999
M is in the order of	0.00015	0.00022	0.00030
P_1 is in the order of		850	
P_2 is in the order of		450	
$b - P_1 M$ is in the order of	0.74	0.80	0.87
$b - P_2 M$ is in the order of	0.86	0.90	0.93

(45)

Expanding log A/B into the log series:

$$\log A/B = 2\left[\left(\frac{A - B}{A + B}\right) + \frac{1}{3}\left(\frac{A - B}{A + B}\right)^{1/3} + \frac{1}{5}\left(\frac{A - B}{A + B}\right)^{1/5} \ldots\ldots\right] \quad (46)$$

	Minimum	Mean	Maximum
Let $b - P_1 M = A$	0.74	0.80	0.87
$b - P_2 M = B$	0.86	0.90	0.93

(46.5)

Then $\frac{A - B}{A + B} = \frac{-1}{30}$ $\frac{-1}{17}$ $\frac{-1}{13}$

And $\log\frac{A - B}{A + B} = -2$ $0.033 + 0.000012$ (Max.); $0.059 + 0.000067$ (Mean); $0.077 + 0.00015$ (Min.) (47)

"The pipeline flow formula based on these new concepts is algebraic, and will permit direct solution for any of the several variables . . ."

The error that would be introduced into Equation 44 by dropping the second and subsequent terms of the log series would be in the order of:

	Per cent
Minimum	0.04
Mean	0.11
Maximum	0.20

The error that would be introduced into the first term of Equation 43 would be 0.024, 0.110, and 0.270% minimum, mean, and maximum, respectively. These errors are small and will be largely compensated for when the "inertia term" is dropped from the second term of Equation 43.

By dropping the second and subsequent terms of the log series, Expression 46 becomes:

$$\log A/B = 2\frac{A - B}{A + B} \quad (47.5)$$

Substituting Equation 46.5 in Equation 47.5 and multiplying by b/M:

$$\frac{b}{M}\log\frac{b - P_1 M}{b - P_2 M} = 2\frac{b}{M}\frac{P_2 - P_1}{2b/M - P_2 - P_1} \quad (48)$$

TABLE 1—VALUES OF M × 1,000

(Temperature, °F.)

Gas gravity	30	35	40	45	50	55	60	65	70	75
0.55	0.1525	0.1469	0.1417	0.1371	0.1329	0.1293	0.1261	0.1234	0.1213	0.1196
0.56	0.1615	0.1552	0.1494	0.1441	0.1393	0.1350	0.1311	0.1278	0.1249	0.1225
0.57	0.1712	0.1644	0.1580	0.1520	0.1466	0.1416	0.1371	0.1330	0.1295	0.1264
0.58	0.1795	0.1722	0.1653	0.1590	0.1530	0.1475	0.1425	0.1380	0.1339	0.1302
0.59	0.1881	0.1804	0.1731	0.1663	0.1599	0.1539	0.1484	0.1434	0.1388	0.1347
0.60	0.1971	0.1890	0.1813	0.1740	0.1672	0.1608	0.1549	0.1494	0.1443	0.1397
0.61	0.2064	0.1979	0.1898	0.1821	0.1749	0.1681	0.1617	0.1558	0.1503	0.1452
0.62	0.2136	0.2048	0.1964	0.1885	0.1809	0.1738	0.1672	0.1609	0.1551	0.1496
0.63	0.2209	0.2118	0.2032	0.1950	0.1872	0.1798	0.1728	0.1662	0.1601	0.1543
0.64	0.2309	0.2215	0.2125	0.2039	0.1957	0.1880	0.1806	0.1737	0.1671	0.1610
0.65	0.2385	0.2289	0.2197	0.2108	0.2024	0.1944	0.1867	0.1795	0.1726	0.1662
0.66	0.2463	0.2364	0.2270	0.2179	0.2092	0.2009	0.1930	0.1855	0.1784	0.1716
0.67	0.2568	0.2467	0.2369	0.2275	0.2185	0.2098	0.2016	0.1938	0.1863	0.1792
0.68	0.2649	0.2545	0.2445	0.2349	0.2256	0.2168	0.2083	0.2002	0.1924	0.1851
0.69	0.2730	0.2624	0.2522	0.2423	0.2329	0.2238	0.2150	0.2067	0.1987	0.1911
0.70	0.2840	0.2731	0.2626	0.2525	0.2427	0.2334	0.2243	0.2157	0.2074	0.1994
0.71	0.2923	0.2812	0.2706	0.2602	0.2503	0.2407	0.2314	0.2225	0.2140	0.2059
0.72	0.3007	0.2894	0.2786	0.2681	0.2579	0.2481	0.2386	0.2295	0.2208	0.2124
0.73	0.3091	0.2977	0.2867	0.2760	0.2656	0.2556	0.2460	0.2366	0.2277	0.2191
0.74	0.3205	0.3089	0.2976	0.2866	0.2760	0.2658	0.2559	0.2463	0.2371	0.2282
0.75	0.3291	0.3173	0.3059	0.2948	0.2840	0.2735	0.2634	0.2537	0.2442	0.2352
0.76	0.3378	0.3258	0.3142	0.3029	0.2920	0.2814	0.2711	0.2611	0.2515	0.2422

Substituting Equation 48 in Equation 43 and rearranging:

$$\frac{m^2}{g A^2} = \frac{\frac{1}{2C}\left[\frac{P_1^2 - P_2^2}{b - M/2\,(P_1 + P_2)}\right]}{\log \frac{\nu_2}{\nu_1} + \frac{2 f L}{D}} \qquad (49)$$

The inertia term, $\log \nu_2/\nu_1$, is to be dropped as negligible. In pipeline flow ν_2/ν_1 will be in the order of the compression ratio—always less than two—and therefore $\log \nu_2/\nu_1$ will always be less than one. The friction factor f will be in the order of 0.002 to 0.004. The ratio L/D will usually be within the range of (50 × 5,280)/(2 to 3) or between 88,000 and 132,000. The value of (2 f L)/D will therefore be between 350 and 1,050 and the error that would be introduced by dropping $\log \nu_2/\nu_1$ would be less than 1.0 in 350 to 1,050, or less than 0.10 to 0.30%. Furthermore this error in the denominator tends to compensate the error of similar magnitude and sign introduced into the numerator by dropping the second and subsequent terms of the log expansion. The effect on the flow rate is equal to one-half of the uncompensated error since it appears under the radical in the final form. For these reasons dropping these two quantities introduces a net error that is most insignificant.

Substitute Equation 31.5 in Equation 49, drop $\log \nu_2/\nu_1$, let $(P_1 + P_2)/2 = P_m$ and rearrange:

$$m = A\left[\frac{\mu D g}{4 f L R T} \times \frac{P_1^2 - P_2^2}{b - M P_m}\right]^{1/2} \qquad (50)$$

Let Q′ be the rate of flow in cubic feet per second past Section 1 measured at flow conditions:

Then

$$Q' = m \nu_1 = m \frac{Z_1 R T}{P_1 \mu} \qquad (51)$$

or

$$m = Q' \frac{P_1 \mu}{Z_1 R T} \qquad (52)$$

Substituting Equation 52 in Equation 50:

$$Q' = A\left[\frac{Z_1^2 R T g D}{P_1^2 \mu 4 f L} \times \frac{P_1^2 - P_2^2}{b - M P_m}\right]^{1/2} \qquad (53)$$

Since the pressures appear as ratios in Equation 53 they may, henceforth, be considered as being in psia. rather than psfa. in order to express Equation 53 in units usual to pipeline practices, the following substitutions must be made.

$$A = \frac{\pi}{4}\frac{d^2}{144}$$

where d is the pipe diameter, in.

$$g = 32.17$$

the gravity constant.

$$R = 1{,}545$$

the universal gas constant.

$$\mu = 28.95\ G$$

where G is the specific gravity of the gas, 28.95 is the average molecular weight of air.

$$D = d/12$$

diameter D in feet to diameter d, in.

$$L = 5{,}280\ L$$

where 5,280 is feet per mile.

$$Q' = \frac{Q}{3{,}600}\,\frac{T}{T_0}\,\frac{P_0}{P_1}\,\frac{Z_1}{Z_0}$$

where Q is the cu. ft. per hr. flow rate at base conditions T_0, P_0, and Z_0 rather than at flow conditions T, P_1, and Z_1 (let $Z_0 = 1$).

Making these substitutions and rearranging:

$$Q = 1.6161\,(T_0/P_0) \times \left[\frac{d^5}{G T L f} \times \frac{P_1^2 - P_2^2}{b - M P_m}\right]^{1/2} \qquad (54)$$

From Equation 33:

$$b = 0.985 + 50\,M \qquad (55)$$

Substituting Equation 55 in Equation 54:

$$Q = 1.6161 \frac{T_0}{P_0}\left[\frac{d^5}{G T L f} \times \frac{P_1^2 - P_2^2}{0.985 - M\,(P_m - 50)}\right]^{1/2} \qquad (56)$$

Equation 56 is the general pipeline-flow formula from which, by substitution of appropriate friction factors f, the special flow formulas, as Weymouth's or the Panhandle, are derived. Additionally, it contains a compressibility correction term:

$$0.985 - M\,(P_m - 50) \qquad (57)$$

Reference to Equation 26 will show this to be equal to Z_m based upon the arithmetic mean of P_1 and P_2. By expansion of the term P_m, Expression 57 becomes:

$$\frac{Z_1 + Z_2}{2}$$

Thus it would appear that Expressions 4 had a better mathematical basis as compressibility correction factors than does Expression 5 which is in far greater current use.

A pipeline-flow formula employing the compressibility correction factor:

$$0.985 - M\,(P_m - 50)$$

will be algebraic and will permit direct algebraic solution for any one of the several variables. Additionally, its use will involve far less calculation than former factors that were functions of Z, and results will be more consistant than those obtained from the unsmoothed, published P-V data.

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New hydrocracking process offers refiners

More flexible gasoline-distillate output

Process uses fixed catalyst bed, produces no catalyst deposit, and can use a wide variety of charge stocks.

A FLEXIBLE TOOL for dealing with excess middle distillates is offered by Universal Oil Products Co's. new hydrorefining process, "Lomax."

Light distillates can be converted into gasolines, with only a small amount of the charge being converted into undesirable C_1-C_3 hydrocarbons. Using a heavy gas-oil charge stock, either middle-distillate or gasoline yields may be maximized—again without excessive fuel-gas production.

The middle distillates need no further refining before they are blended into salable products. To meet the requirements of today's premium and superpremium gasolines, the heavy naphtha should be Platformed. However, this reforming step may not be required if the naphthas are to be used in regular-grade gasoline.

These developments were outlined at the annual meeting, Western Petroleum Refiners Association, San Antonio, March 28-30, by M. J. Sterba and C. H. Watkins, Universal Oil Products Co.

Fixed bed. The Lomax process uses a fixed catalyst bed. As it uses an environment of hydrogen under pressure, the products are very low in olefins. In contrast with catalytic cracking, the process produces no catalyst deposit and a much smaller quantity of light hydrocarbon gases. Complete recycling of material boiling above gasoline can be carried out without sacrificing yields or quality.

Another feature of the process is that the light naphtha, comprising the butanes, pentanes and hexanes, is composed predominantly of the branched isomers. Aromatics in the charge stock can be either saturated or substantially retained, depending upon the requirements in any particular case.

Product distributions. A wide variety of charge stocks can be used in the Lomax process. These include kerosines, stove oils, diesel fuels, catalytic cycle oils, vacuum gas oils, coker distillates, and other distillates derived from catalytic or thermal operations. Inspections of typical fractions processed in pilot-plant studies are given in Table 1.

Product-distribution data for the East Texas kerosine in once-through operation are shown in Fig. 1.

The amounts of the three fractions increased with conversion; the amount of light naphtha increased more rapidly than did the amount of heavy naphtha. At all conversion levels the volume of liquid products exceeded 100%, and the amount of C_1-C_3 production remained small.

The three light-cycle oils showed similar relationships. In the case of the Leduc light-cycle oil, however, slightly greater proportions of heavy naphtha fractions were obtained at a given conversion level than were obtained with the other oils.

This is reflected in Table 2, which compares the product distributions obtained at 60% conversion level for four different charge stocks. In general the proportion of C_4-plus, with respect to total products, increased with boiling range of the charge stocks. Also, as shown, the ratio of light naphtha to heavy naphtha varied considerably.

These variations and product distributions are not solely a function of the charge stock used. Different process conditions can be used to vary the distributions, as shown in Table 3.

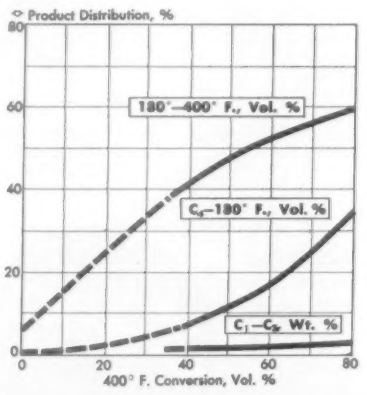
The data were obtained from processing a 28° API gas oil having a boiling range of 200°-900° F.

The mixed Wyoming-West Texas vacuum gas oil given in Table 1 was Lomax-processed to maximize middle distillate production. When this was done the ratio of middle distillate to gasoline was about 2, whereas by processing for gasoline production the ratio was less than 0.5.

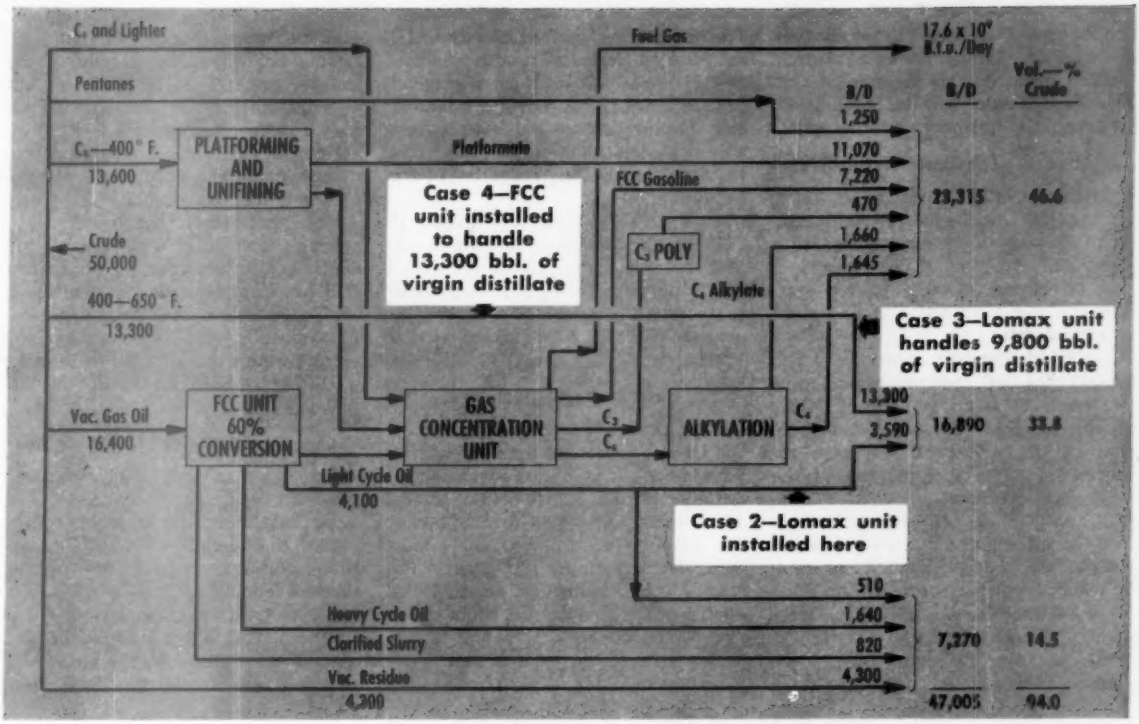
Inspections of typical fractions obtained from the Lomax processing of

TABLE 1—CHARGE-STOCK PROPERTIES

	Kerosine, E. Texas	Light-cycle oils		Vac. gas oil
		Oklahoma	Leduc	Wyo.-W. Tex.
°API at 60° F.	41.3	28.4	25.9	20.6
Sp. gr. 60/60	0.8189	0.8849	0.8990	0.9303
Engler distillation:				
I.b.p., °F.	366	450	448	590
10%	412	484	495	722
30%	432	502	530	790
50%	446	518	555	835
70%	465	536	584	872
90%	496	560	620	920
E.p.	542	599	666	.....
Sulfur, wt. %	0.0356	0.689	0.69	2.58
Bromine number	.....	.....	10.9	.....
FIA analysis:				
Aromatics, vol. %	16.8	45.6	51.2	.....
Olefins, vol. %	0.4	3.7	5.4	.....
P. + N., vol. %	82.8	50.7	43.4	.....



PRODUCT DISTRIBUTION obtained from the Lomax processing of an East Texas kerosine at different levels of conversion. Fig. 1.



TYPICAL 50,000-BBL. REFINERY, into which the Lomax process is fitted at various points to adjust yields of gasoline and middle distillates. Case 1 is the base case for a refinery operating without Lomax. Fig. 2.

kerosine are shown in Table 4. The butane fraction contains 80 wt. % isobutane. The pentane fraction contains about 85 wt. % isopentane. The 115°-180° F. fraction contained 63.3 wt. % methylpentanes and 21.3 wt. % methylcyclopentane.

The C_5 fraction and the 115°-180° F. fraction were mixed and research-method octane numbers of 82.4 clear and 96.3 with 3 ml. of TEL were obtained. The 180°-400° F. fraction contained 46 vol. % naphthenes and 17 vol. % of aromatics.

Refinery applications. Application of the process to situations which might be met in a refinery, using a sequence of well-known processing steps, was tested by setting up a hypothetical base case to which Lomax is added or used as a replacement for existing processes.

All refining schemes were designed to process 50,000 bbl. per day of 36.70 API Mid-Continent crude. Products would be:

A. A motor-gasoline pool.

B. A middle-distillate pool having a nominal boiling range of 400°-650° F.

C. A heavy fuel oil having a viscosity of 300 S.f.S. at 122° F.

D. Fuel gas.

The crude considered for this study is shown resolved into several contiguous cuts in Table 5.

In the several schemes to be described, the C_4 and lighter will be routed to appropriate gas recovery while the pentanes will always be placed directly into the product gasoline pool. The C_6-400° F. virgin

TABLE 2 — PRODUCT DISTRIBUTIONS OBTAINED FROM LOMAX PROCESSING VARIOUS PETROLEUM STOCKS

	Kerosine, E. Tex.	Light-cycle oils—Oklahoma	Light-cycle oils—Leduc	Vac. gas oil, Wyo.-W. Tex.
°API	41.3	28.4	25.9	20.6
Boiling range, °F.	366-542	450-600	448-666	590-920
Product distribution at 60% 400° F. conversion:				
C_1-C_2, wt. %	1.0	1.7	1.0	0.9
C_4-180° F., vol. %	16	19	15	21
180°-400° F., vol. %	53	57	64	56
Total C_4+ vol. %	109	116	119	117

TABLE 3—PRODUCT DISTRIBUTION VARIATIONS FROM LOMAX PROCESSING GAS OIL AT VARIOUS CONDITIONS

Product distribution at 50% 400° F. conversion:	A	B	C	D
C_1-C_2, wt. %	0.7	1.0	1.1	1.3
C_4-180° F., vol. %	13	15	19	21
180°-400° F., vol. %	53	49	44	43
400°-650° F., vol. %	28	16	16	13
400° F.+, vol. %	50	50	50	50
Total C_4+ vol. %	116	114	113	114

TABLE 4—MID-CONTINENT CRUDE BREAKUP

	Vol. %	Bbl./day	°API
C_3 and lighter	0.5	250	....
Butanes (29% isobutane)	1.8	900	....
Pentanes (30% isopentane)	2.5	1,250	....
C_6-400° F. gasoline	27.2	13,600	52
400°-650° F. distillate	26.6	13,300	37.3
650° F. + gas oil	32.8	16,400	25.2
Vacuum bottoms (75 pentane)	8.6	4,300	7.3
	100.0	50,000	37.3

gasoline will be Unifined and processed in a Platformer to produce a debutanized gasoline having a research method clear octane number of 95. The Platformate will be routed directly to the refinery gasoline pool.

Case 1—The Basic Refinery

In this refining sequence, to which all modifications will be compared, the following processing steps were integrated as shown in Fig. 2.

... Platforming. The C-400° F. naphtha was Unifined and processed in a Platformer.

... Fluid catalytic cracking. The 16,400 bbl. of vacuum gas oil was processed at a conversion of 60%. All heavy-cycle oils and a small portion of the light-cycle oil were required to adjust the viscosity of the heavy fuel-oil blend.

... Alkylation and polymerization. All C_4 and lighter hydrocarbons are handled in a gas-concentration unit, in which recoveries of 98% and 80% were assumed for the C_4 and C_3 fractions respectively. Motor alkylate was produced from the recovered C_4 fraction which contained more than sufficient isobutane to satisfy the butylenes. The C_3 olefins in the recovered C_3 cut were converted to motor polymer.

The 400°-650° F. distillate-product pool includes all the virgin distillate in that boiling range, plus the excess light-cycle oil remaining beyond that required for viscosity reduction of the heavy fuel oil.

Product yields are summarized in Table 6. For the base case the available butanes, after alkylation of all of the butylenes bring the Reid vapor pressure of the pool gasoline to just over 8 psi. Its fully leaded octane number is slightly over 100.

Case 2—Light-Cycle Oil

As a first step in the application of the Lomax process to the reference refinery, consider the conversion to gasoline of the 3,590 bbl. of excess FCC light-cycle oil. This amounts to the addition of a 3,590-bbl. Lomax unit. If the naphtha produced in this unit is to be Platformed, an additional Platforming capacity of about 3,500 bbl. would be needed beyond that in Case 1.

Product yields for this case are summarized in Table 6 and represent the situation where the 695 bbl. of light Lomax naphtha goes directly to the gasoline pool. The 180°-400° F. Lomax naphtha is Platformed to 95 research clear octane number. Reforming of the virgin and Lomax naphthas makes more than sufficient hydrogen to supply the Lomax unit.

The pool-gasoline octane numbers remain essentially unchanged from Case 1, and the vapor pressure situation has improved slightly. However, the pool-gasoline yield has risen from 46.6 to 54.7 vol. % of crude. Net effect of the change would be to make 4,037 bbl. of gasoline from 3,590 bbl. of cycle oil.

Case 3—400°-650° F. Distillate

For this case study, the Lomax unit will be added to the structure of the basic case. Because it is desired to reform the Lomax 180°-400° F. naphtha, additional Platforming capacity will be required.

It is desirable to process as much of the 13,300 bbl. of virgin distillate as will be permitted by the availability of hydrogen from the Platforming

TABLE 5—SUMMARY OF PRODUCT YIELDS FOR VARIOUS REFINING SCHEMES PROCESSING 50,000 BBL. PER DAY OF CRUDE
(Figures in barrels per day)

	Case 1—Basic refinery	Case 2—Lomax on excess FCC light cycle oil	Case 3—Lomax on 400°-650° F. virgin distillate	Case 4—FCC on 400°-650° F. virgin distillate	Case 5—Lomax on vac. gas oil maximize gasoline
Gasoline pool:					
C_5 from crude	1,250	1,250	1,250	1,250	1,250
Platformate from virgin naphtha	11,070	11,070	11,070	11,070	11,070
Platformate from Lomax naphtha	.....	2,940	6,920	.....	11,720
C_5/C_6 from Lomax	.....	695	2,060	.....	4,800
FCC gasoline	7,220	7,220	7,220	12,670	.....
C_4 alkylate	1,660	1,660	1,660	3,370	.....
C_3 poly	470	470	470	1,050	.....
C_4 for vapor pressure	1,645	2,047	2,830	2,375	3,210
Total gasoline	23,315	27,352	33,480	31,785	32,050
Vol. % of crude	46.6	54.7	67.0	63.5	64.1
Research clear ON	93.4	93.1	92.9	93.5	92.4
Research + 3 ml. TEL ON	100.2	100.1	100.3	100.4	100.1
Reid vapor pressure	8.1	8.4	9.2	9.9	10.0
400°-650° F. distillate:					
From crude	13,300	13,300	3,500	.....	10,680
From Lomax unit	.....	.....	.....	.....	.....
FCC light-cycle oil	3,590	.....	3,590	7,090	.....
Total	16,890	13,300	7,090	7,090	10,680
Vol. % of crude	33.8	26.6	14.2	14.2	21.4
Heavy fuel oil (300 S.s.F. at 122° F.):					
Vacuum unit residue	4,300	4,300	4,300	4,300	4,300
Clarified slurry	820	820	820	820	.....
Heavy-cycle oil	1,640	1,640	1,640	1,640	.....
Light-cycle oil	510	510	510	510	.....
400°-650° F. dist. from crude	.....	.....	.....	.....	2,620
Total	7,270	7,270	7,270	7,270	6,920
Vol. % of crude	14.5	14.5	14.5	14.5	13.8
Excess butanes	0	0	0	0	900
Total C_4+, vol. % of crude	94.0	95.8	94.7	92.2	101.1
Fuel gas:					
Lb. per hour	29,395	30,548	36,015	42,530	33,430
10^9 B.t.u./day gross heating value	17.6	16.4	19.5	24.8	17.3
Extraneous hydrogen, 10^6, S.c.f.d.	.....	0	0	.....	21.8

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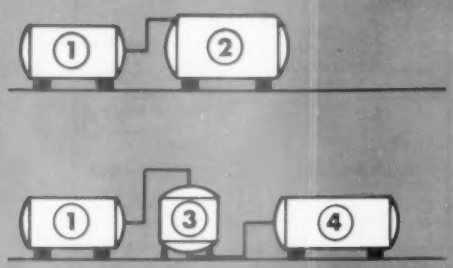
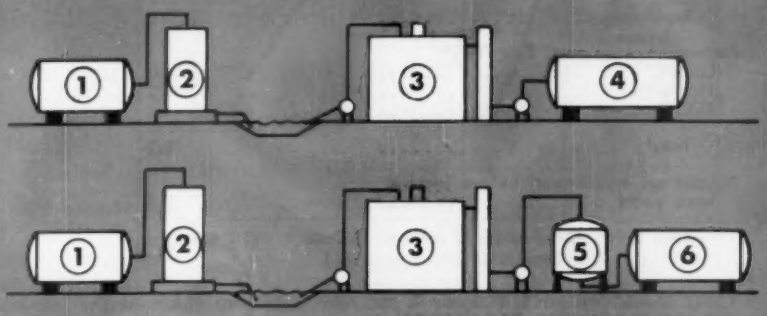


1. Oil Skimmers
2. Filta-Wash
3. Filters
4. Backwash Tanks

OR AN **OPEN SYSTEM?**



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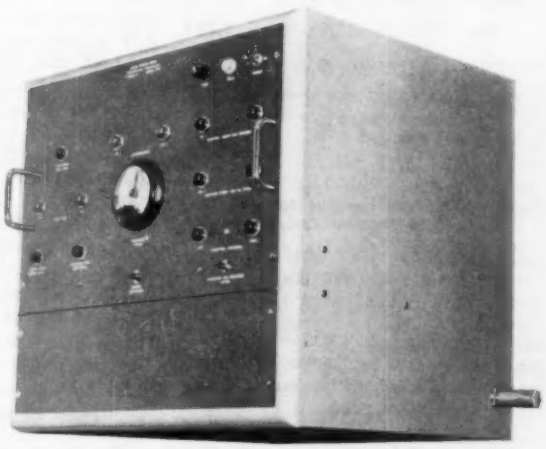

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TABLE 6—ECONOMICS FOR VARIOUS REFINING SCHEMES

	Case 2—Lomax on excess FCC light-cycle oil		Case 3—Lomax on 400°-650° F. virgin distillate		Case 4—FCC on 400°-650° F. virgin distillate	
	Bbl./day	$/day	Bbl./day	$/day	Bbl./day	$/day
Product value relative to basic Case 1:						
Gasoline at $5.25/bbl.	+4,037	+21,190	+10,165	+53,360	+8,470	+44,470
Mid. dist. at $3.80/bbl.	−3,590	−13,640	− 9,800	−37,240	−9,800	−37,240
Heavy fuel at $1.80/bbl.	0	0	0	0	0	0
Fuel gas at $0.30/10⁶ B.t.u.	− †1.2	− 360	+ 1.9	+ 570	+ 7.2	+ 2,160
Total		+ 7,190		+16,690		+ 9,390
Operating costs,* $/day						
Lomax		2,431		3,040		
Platformer		1,110		2,290		
FCC, gas con., alky., poly.						6,170
Total		3,541		5,330		6,170
Estimated plant cost, $ × 10⁶:*						
Lomax		2.0		3.9		
Platformer		1.2		2.1		
FCC, gas con., alky., poly.						6.75
Total		3.2		6.0		6.75
Payout on investment (before income tax), years		2.5		1.5		6.0

*For units added to basic scheme of Case 1. †10⁹ B.t.u./day.

TABLE 7—ECONOMICS FOR CASE 5, LOMAX PROCESSING OF 16,400 BBL. PER DAY OF VACUUM GAS OIL TO MAXIMIZE GASOLINE

Product value relative to basic Case 1:	Bbl./day	$/day
Gasoline at $5.25/bbl.	+8,735	+45,860
Mid-dist. at $3.80/bbl.	−6,210	−23,600
Heavy fuel at $1.80/bbl.	− 350	− 730
Fuel gas at $0.30/10⁶ B.t.u.	+ *3.5	+ 1,050
Outside H_2 at $0.50/M.s.c.f.	†21.8	−10,900
Total		+11,680
Operating costs, $/day:		
For Lomax added		+ 5,207
Platformer added		+ 3,700
For FCC removed		− 6,920
Net		+ 1,987
Estimated plant cost, $ × 10⁶:		
For Lomax added		+ 6.5
Platformer added		+ 3.1
For FCC removed		− 8.15
Net		+ 1.45
Payout of Lomax relative to FCC (before income tax), years		0.5

*10⁹ B.t.u./day. †10⁶ s.c.f./ day.

unit. Accordingly, 9,800 bbl. of virgin distillate can be Lomax-processed, leaving 3,500 bbl. to be routed to the refinery distillate pool.

Noting the product yields summarized in Table 6, it is seen that the gasoline pool has been increased to 33,480 bbl. or 67 vol. % of the crude. Its octane numbers are not changed from either of the previous cases, and its Reid vapor pressure is almost 10 psi.

The remaining 3,500 bbl. of unprocessed virgin distillate, along with the light FCC cycle oil, yield a refinery-product distillate pool amounting to only 14.2 vol. % of crude.

Case 4—Virgin Distillate

It is of interest to compare the conversion of the virgin 400°-650° F. fraction by cracking processes other than Lomax. In this study, the entire 13,300 bbl. of 400°-650° F. fraction was charged to a separate FCC unit. The conversion was set at 73.7 vol. % so that the cycle oil production of 3,500 bbl. would correspond to the amount of virgin distillate bypassing the Lomax unit in Case 3.

This case involves the insertion of a 13,300-bbl. FCC unit and additional gas concentration, alkylation, and polymerization facilities to process the 400°-650° F. virgin distillate.

Reference to Table 6 shows this approach makes about 1,700 bbl. less pool gasoline, at the same fuel-oil yields, than was obtainable with Lomax. The pool-gasoline octane numbers, although slightly higher, are not greatly different from those observed for Case 3. The middle distillate pool is entirely cycle oil with quality properties distinctly inferior to the pool in Case 3.

Case 5—Middle Distillate

The process can be applied to the vacuum gas oil to maximize the yield of middle distillate by recycling only that material boiling above the desired middle-distillate end point. On the other hand, the operation can be designed to maximize gasoline yields by recycling everything boiling above the gasoline end point. In this case the production of 650° F. e.p. middle distillate will be maximized by recycling the material boiling above 650° F.

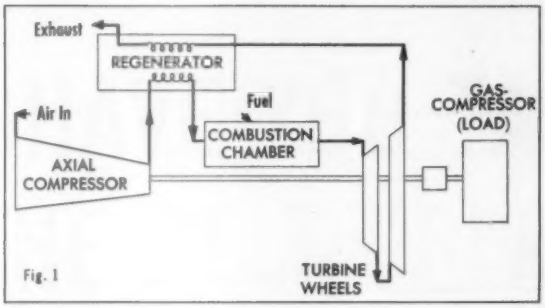
In setting up the product yields for this operation a Lomax unit was considered to replace the FCC unit and its gas concentration, alkylation, and polymerization units in the basic refining scheme. Platforming capacity in addition to that already shown in Case 1 is required to accommodate the 5,590 bbl. of 180°-400° F. naphtha made by the Lomax unit.

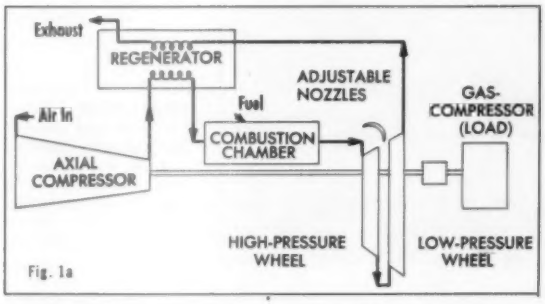
This change brought the refinery middle-distillate pool yield up to 44.6 vol. % of crude.

Economics of Lomax Processing

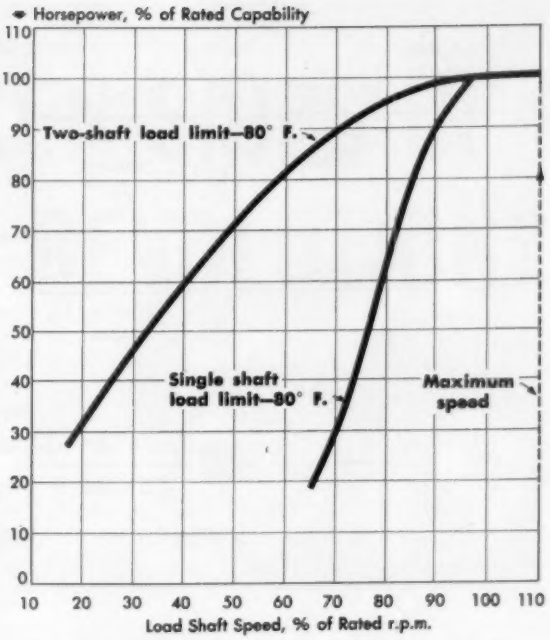
The economics for Cases 2, 3, and 4 are summarized in Table 6. A payout time before income tax of 2.5 years is indicated for the addition of a 3,590-bbl. Lomax unit to process excess FCC light-cycle oil. A shorter payout time, only 1.5 years, is shown for Case 3. If the light virgin distillate were to be processed in an FCC unit, as in Case 4, a payout of 6 years was estimated.

Table 7 summarizes the economics of Case 5. Even though the Lomax equipment costs slightly more to operate, and in initial investment, the payout time for this additional investment is only 6 months more than conventional catalytic cracking. The earnings after payout are very attractive.





COMPARISON of simpler lower-cost single-shaft gas turbines, Fig. 1, with higher cost more versatile two-shaft type, Fig. 1a.



SPEED CHARACTERISTICS of single-shaft and two-shaft gas-turbine horsepower. Fig. 2.

Two-shaft or single-shaft gas turbines

. . . for your compressor station?

Here are some operating considerations in making proper selection

BY J. L. MANGAN
Manager, Marketing Research, Product, and Sales Planning
and
T. C. HEARD
Application Engineer,
General Electric Co.

WITHIN the past year several single-shaft combustion gas turbines have begun operation on gas pipelines. Until this time, and except for an early small-size unit, all gas turbines on pipelines have been of the two-shaft type.

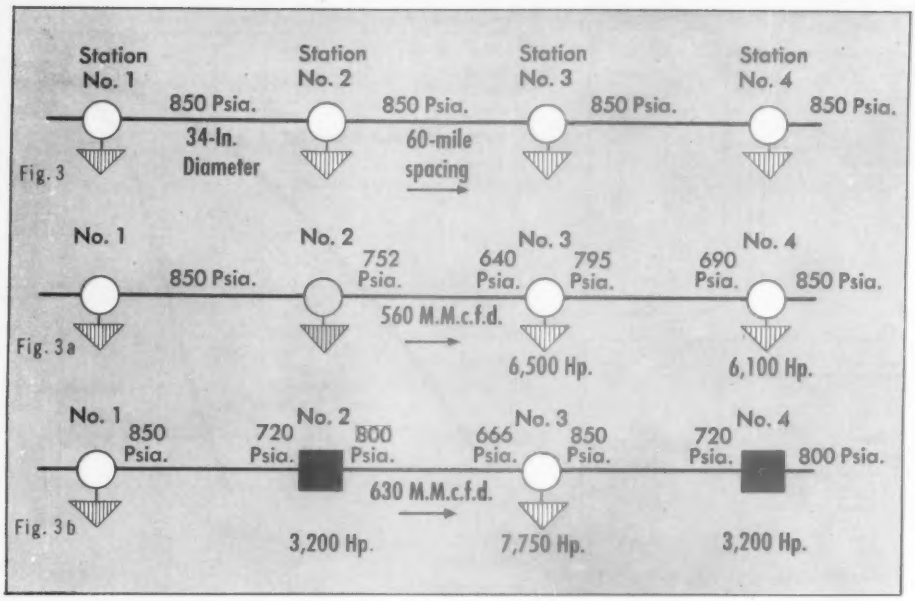
The question is raised as to why single-shaft turbines haven't been used more extensively, since the cost of a single-shaft turbine is somewhat less than the cost of a two-shaft turbine of the same size and cycle arrangement (both with regenerators). The answer is that the usual varying conditions of most main-line compressor stations can more easily be handled by two-shaft turbines. The single-shaft turbines have generally been applied as peak-loading stations (for use only on high peak-flow conditions), and where line variations can be handled by more flexible adjoining compressor stations.

The following discussion will bring out the salient operating considerations in the selection of single or two-shaft gas turbines for driving centrifugal compressors on a gas pipeline. To simplify any comparisons, it will be assumed that the rated horsepower and output speeds and the thermal efficiencies at the rating point are the same for both the single and the two-shaft units.

Difference Between Two Types

Fig. 1 shows the schematic diagrams of the single and two-shaft gas turbines. In either case, the air is compressed in an axial-flow compressor, fuel is added and burned in the combustion chamber, and the resulting hot gas is expanded through the turbine wheels. The power derived from the turbine wheels is proportional to the mass of air flow and the temperature drop across the turbine wheels. The power available to drive the load is the difference between this total power and the power required by the axial compressor of the gas turbine.

In this type of machinery, the amount of air compressed is proportional to the speed of the axial compressor. Therefore, until the axial compressor is up to approximately 60% speed, there is insufficient air flow to fire the machine and drive its own axial compressor. With the output shaft mechanically connected to the shaft of the axial compressor as in a single-shaft gas turbine, the result is a machine that can operate only in a limited speed range.



OPERATION with gas turbines and centrifugals on gas pipeline, Fig. 3, with one station shut down, Fig. 3a; with upstream station at reduced discharge pressure, Fig. 3b.

On the other hand, the two-shaft machine can operate at lower output speeds, because the axial compressor and its high-pressure turbine can be run at the speed required to furnish the necessary air while the low-pressure turbine operates independently at speeds to satisfy the load. Typical comparable speed-horsepower characteristics of single and two-shaft units are shown on Fig. 2.

The addition of an adjustable nozzle, between the high-pressure and low-pressure turbines of a two-shaft gas turbine, provides a means of balancing the energy between the two turbines. The aims are to compensate for variations in turbine and compressor performance resulting from manufacturing tolerances; to obtain optimum efficiency at all loads and under varying ambient temperatures; and to allow more horsepower to be obtained at high ambients without overfiring to excessive turbine temperatures and at low ambients without overspeeding the axial air compressor.

Operating Conditions

In order to demonstrate the operating conditions required of a gas turbine driving pipeline centrifugals, assume a number of turbine stations on a line as shown in Fig. 3. Assume that each station normally holds 850-psia. maximum working discharge pressure and that rated (100%) flow is 700 M.M.s.c.f.d.

As the flow changes from time to time through this line, the compressor speed and horsepower must also change to hold 850-psia. discharge. In Table 1, operating points 1 through 4 are given to show the speeds and horsepowers the gas turbine must satisfy to produce 110, 100, 90, and 80% of the rated flow. These required speeds and horsepowers are determined from the centrifugal-compressor characteristics of Fig. 4. Notice that the four selected operating points, 1 through 4, fall right along the compressor "design line," giving the best possible efficiency and showing that this compressor has been properly applied.

These same normal operating points are plotted on the horsepower-speed characteristics of a single-shaft gas turbine, Fig. 5, and a two-shaft unit, No. 6. Note these characteristics show the turbine capability at ambient air temperatures (at inlet to gas-turbine air compressors) at 0°, 40°, 80°, and 100° F.

If the four normal operating points are connected by a dashed line as shown, then this dashed line can be called a "normal operating" line. However, the compressor manufacturers normally guarantee the compressor design horsepower with a ±4% tolerance. Therefore, for sound engineering, a band of possible operating con-

TABLE 1—TURBINE AND COMPRESSOR OPERATING POINTS

Point No.	Line flow M.M.s.c.f.d.	Station inlet pressure	Station discharge pressure	Compressor inlet (cu. ft./min.)	Compressor pressure ratio	Compressor speed (% r.p.m.)	Turbine hp. (% rated)
1	770 (110%)	674	850	10,200	1.269	5,520 (102.3%)	8,750 (115%)
2	700 (100%)	697	850	9,150	1.233	5,160 (95.6%)	7,020 (92.5%)
3	630 (90%)	726	850	7,950	1.175	4,500 (83.3%)	4,830 (63.6%)
4	560 (80%)	752	850	6,800	1.135	3,920 (72.5%)	3,410 (45%)
4a	560 (80%)	*640	§795	8,000	1.260	5,270 (97.5%)	6,500 (85.5%)
5	620 (88.6%)	*590	§777	9,700	1.338	6,000 (111%)	9,000 (119%)
6	560 (80%)	†752	850	8,000	1.135	4,050 (75%)	4,200 (55.4%)
7	560 (80%)	‡720	850	7,100	1.195	4,640 (86%)	5,000 (66%)
8	630 (90%)	¶666	850	8,600	1.290	5,550 (103%)	7,750 (102%)
9	560 (80%)	¶695	850	7,400	1.237	5,020 (93%)	5,800 (76.4%)

*Upstream station is shut down. †Bypass (or recirculating) valve open around compressor. ‡Suction valve throttling. §Next downstream station boosts pressures to 850 psia. ¶Upstream station discharge is reduced to 800 psia.

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The change from Multi-V to Multi-Wedge is revolutionizing belt drives. A simple change in shape gives the Wedge Belt greater efficiency. Thus the number of belts can be less, diameters can be reduced 30 to 50% and center distances cut 20% for the same transmitted horsepower. In fact, Multi-Wedge drives result in initial savings up to 20%.

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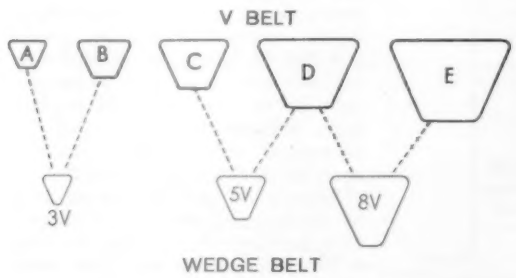
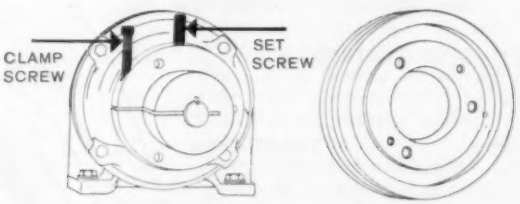
The cord layer near the top of either belt carries the load. This layer is, however, only efficient in the portion supported by side walls (red areas). Because more of its top section is over the side walls, the Wedge belt is more efficient than a V belt.



Because the smaller Wedge belt does more work, the number of sizes have been reduced without loss of flexibility. The new Wedge belts are available in three standard sections: 3V, 5V and 8V. Stock 3V and 5V sheaves cover horsepower ranges through 200 hp. Made to order 8V sheaves will be used for 200 to 2,000 hp. requirements.



Worthington QD sheaves are preferable for Multi-Wedge drives. The clamp screw simplifies installation, assures permanent alignment, and makes it possible to use a set screw without causing hub distortion that might cause eccentric runout. The set screw prevents "key drift" by locking the key securely in place. You install QD sheaves easily—one part at a time. If change in speed is required, you simply install another sheave on the hub which remains anchored to the shaft.

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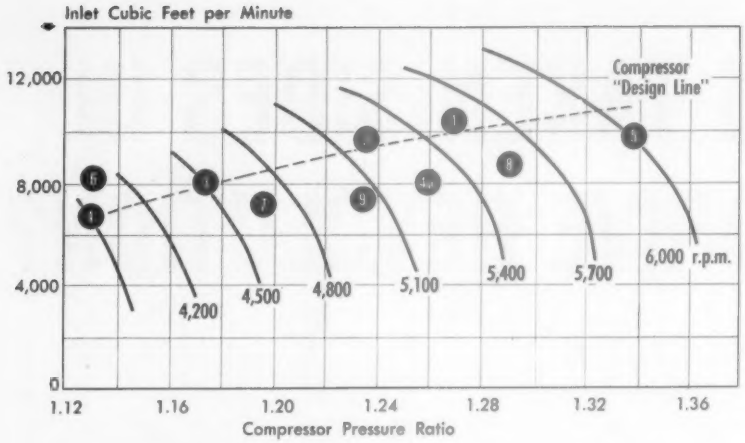
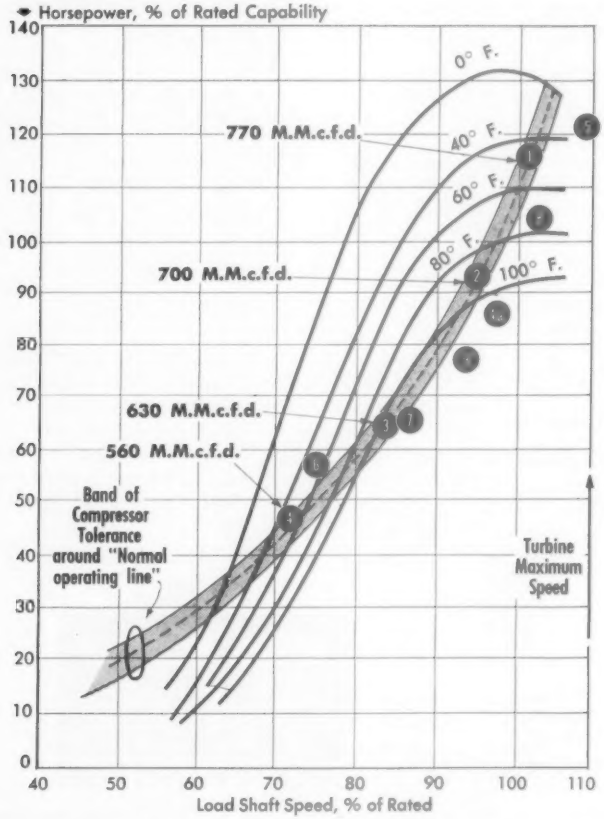


CHARACTERISTICS of single-stage centrifugal compressor. Fig. 4.

ditions should be considered, with a vertical width of at least ±4% of rated horsepower. Such a band of operating conditions is shown on Figs. 5 and 6.

Single-Shaft Turbine Operation

Normal conditions. Fig. 5 demonstrates the operating limits of the single-shaft gas turbine. Note that when turbine inlet air is 100° F., the turbine-centrifugal can operate only in a very narrow range of flows depending on the actual compressor tolerance—if at 100° F. ambient, the compressor works on the upper limit of its tolerance, the turbine may not be able to operate at any flow.



OPERATING POINTS on single-shaft gas-turbine characteristics. Fig. 5.

With the usual turbine temperature controls, the turbine will keep backing down in speed in an attempt to find a load that it can support; and unless it reaches a point within the capability limitations at the existing ambient temperature, it will trip out on overtemperature.

If the turbine inlet temperature is 80° F., this turbine-compressor could support steady flows between approximately 600 and 720 M.M.s.c.f.d. Thus with a single-shaft gas turbine there is a minimum-flow limit as well as a maximum-flow limit imposed by turbine inlet temperature. In warm weather this turbine and centrifugal compressor would be somewhat handicapped.

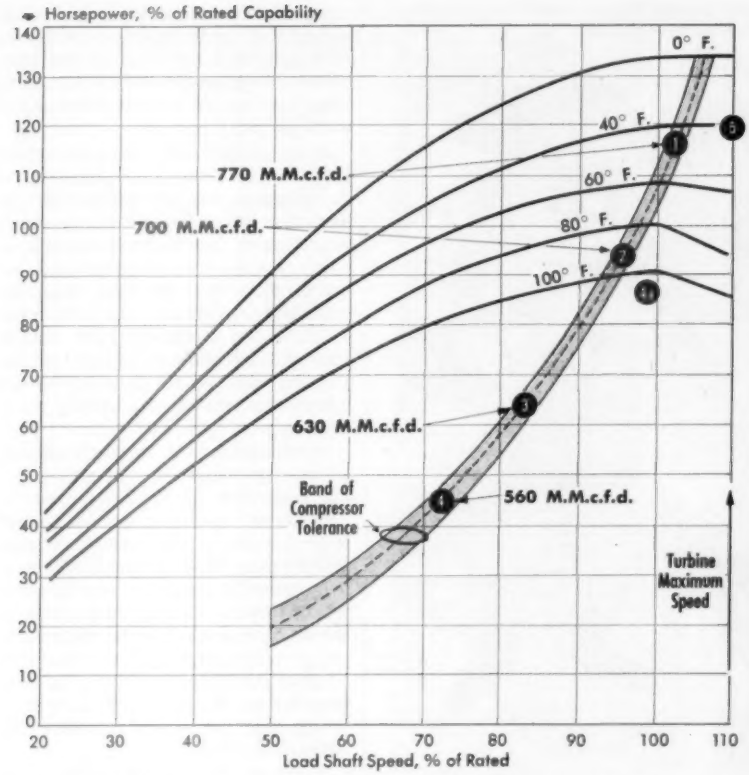
Upstream-station shutdown. If the flow is low enough, say 560 to 620 M.M.s.c.f.d., as it may be when the weather is warm, the upstream station can be shut down so that only every other station is used, as indicated by points 4 and 5 (Fig. 3a, Table 1, and on Fig. 5). This particular operating point is within the warm-weather capacity of the single-shaft turbine.

This operation with one station shut down is not always desirable over prolonged periods, however, because the pipeline uses more total horsepower, and hence more fuel, this way. With the upstream-station shutdown, the station under consideration boosts the pressure only to 795 psia., leaving the downstream station to boost the pressure to 850 psia. (see Fig. 1a). These two stations must run at a combined load of 6,500 plus 6,100 hp., or 12,600 hp. total. This compares with a total of 3 × 3,410 = 10,230 hp. when all three stations are able to hold 850-psia. discharge pressure.

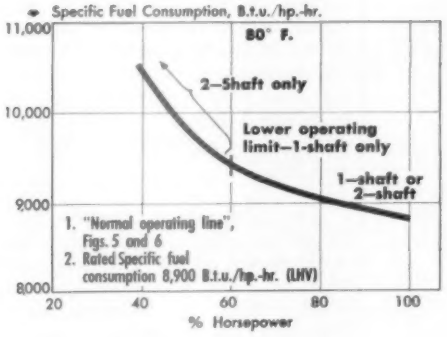
Upstream station at reduced discharge pressure. If the upstream station is flexible (two-shaft turbine-driven centrifugals or reciprocating-engine compressors) and can operate at a reduced discharge pressure during low flows, then it is often possible to load the single-shaft turbine under consideration to a speed and horsepower within its capability, and boost its discharge to normal.

Assume the upstream station drops its discharge pressure to 800 psia. Now the single-shaft turbine will have a lower suction pressure than usual. On Table 1, points 8 and 9 show this type of operation for 630 and 560 M.M.s.c.f.d. flow. Note that while point 9 is within the capability limit of the turbine, point 8 is above even the 80° F. capability.

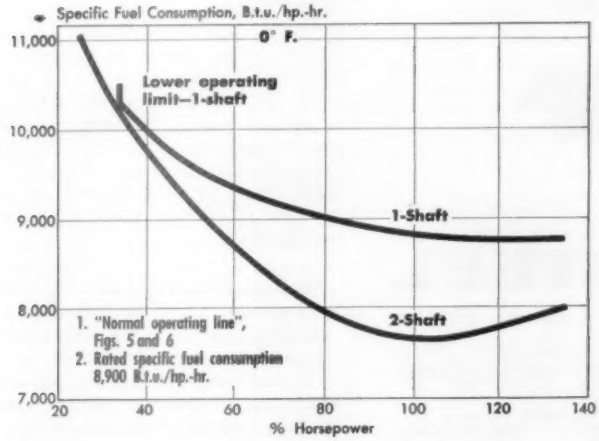
In the case of point 8 (630 M.M.s.c.f.d.) the upstream station uses about 3,200 hp., which, with the 7,750



OPERATING POINTS on two-shaft gas-turbine characteristics. Fig. 6.


Specific Fuel Consumption, B.t.u./hp.-hr.
80° F.
2–Shaft only
Lower operating limit–1-shaft only
1–shaft or 2–shaft
1. "Normal operating line", Figs. 5 and 6
2. Rated Specific fuel consumption 8,900 B.t.u./hp.-hr. (LHV)
% Horsepower

PERFORMANCE difference between specific fuel consumption of single-shaft and two-shaft gas turbines. Fig. 7.



hp. of the single-shaft turbine station, means a combined total of 10,950 hp. for the two stations (see Fig. 3b). If both stations were able to operate at 850-psia. discharge, then the combined horsepower of both would be 9,660 hp., or 1,290 hp. less. Again this shows the advantage of being able to operate all stations at maximum discharge pressure.

Modified centrifugal-compressor characteristics. Upon close examination of the "normal operating line" (along points 1 through 4) of Fig. 5, the reader might reason that the compressor characteristics could have been chosen more advantageously. Why not change the compressor wheel design so that these points fall at higher speeds (easily done)—and move the normal operating line farther to the right for more operating room at high ambient temperatures? This is detrimental in two ways:

1. With the normal operating line at higher speeds, the turbine then would not be able to take advantage of its inherent ability to produce more horsepower in cold weather. The turbine maximum speed would be reached before maximum horsepower would be used.

2. If the normal operating line were moved to the right (to higher speeds), then points 4a and 5 would also be moved to higher speeds, and again maximum turbine speed would be reached before the full turbine horsepower capability in cold weather could be utilized. Especially in this case when the upstream station may be shut down due to an outage at a time when flow is high, the use of the maximum turbine capacity is very important. The condition shown by point 5 represents maximum turbine speed and gives a flow of about 90% of normal. Moving the normal operating line to the left, if additional speed range were available, would permit increased flow with the upstream station out.

Throttling and recirculating. It is possible to recirculate gas around the centrifugal, or throttle the suction, in order to handle certain operating conditions with the single-shaft gas turbine? Usually not by recirculating, but sometimes by pinching down the suction valve. Assume that 560-M.M.s.c.f.d. line flow is to be maintained, but the ambient temperature is 100° F. (As shown on Fig. 5, normal operation is possible only at approximately 60° F. ambient.)

As shown by point 4 on Table 1, the normal station inlet flow is 6,800 cu. ft. per minute. By opening a bypass or recirculating valve around the

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compressor, some of the gas circulates around the compressor—so that more flow can be maintained in the compressor than passes down the pipeline. The pressure ratio remains the same (1.135).

Refer to the compressor characteristic (Fig. 4). If the recirculating valve is opened so that 8,000 cu. ft. per minute is going through the compressor, then it would have to run at 4,050 r.p.m. (75% speed) and requires 4,200 hp. (55.4%) from the gas turbine to produce the 1.135 ratio as shown by operating point 6. Obviously recirculating has not helped, for this new operating point is not within the 100° F. capability of the turbine.

Now, instead of recirculating, assume the compressor inlet valve is pinched down so that instead of the compressor operating at the station inlet pressure at 752 psia. it operates at 720 psia. This means it will have to operate at a higher ratio to maintain 850-psia. discharge pressure as shown by point 6 on the compressor characteristic Fig. 4, and on Table 1. Note that the new compressor inlet pressure of 720 psia. means 7,100-cu.-ft. per minute inlet for 560 M.M.s.c.f.d.

This new operating point, 4,640 r.p.m. (86% speed) at 5,000 hp. (65.8%), is plotted as point 7 on the turbine characteristic (Fig. 5). Now we are within the 100° F. capability of the single-shaft turbine. However, the turbine is now producing 1,500 hp. more than if throttling were not necessary, (compare points 4 and 7) and this is expensive in terms of fuel use.

Two-shaft turbine operation. Fig. 6 shows the two-shaft-turbine capability with all the normal operating points (1-4) of Table 1. Unlike the single-shaft turbine, the two-shaft turbine has plenty of margin for operation at low flows. Here, such variations as might occur with gas specific gravity, inlet flow temperature, ratio of specific heats, range of compressor manufacturer's tolerance, etc., will not cause difficulty because there is plenty of speed range. Throttling of compressor suction, operation with reduced station discharge pressure, and other operating inefficiencies required by lack of turbine speed range are not required.

Multiple turbine stations. Where two identical centrifugal compressors are operating in series in the same station, the second compressor's inlet gas is at higher temperature, and the inlet cubic feet per minute is slightly lower than that of the first compressor. If

the two turbines are loaded equally, the second one will run at slightly lower speed than the first turbine. Thus the normal operating line of the second unit will fall to the left of the normal operating line of the first unit but must still remain within the turbine-capability line.

By referring to Fig. 5, visualize a second normal operating line to the left of the existing one on this single-shaft turbine. This second unit has even less operating room than the first.

Of course the second compressor does not have to be of exactly the same design as the first, and can be designed for slightly higher speeds. However, a different compressor-wheel design means added care and effort must be taken for the right answer, and the problem of close operating margin is still with the station as it was with the original single unit. With dissimilar compressors, single-unit operation of the second unit may present added difficulty. All of these problems are minimized, if not eliminated, when two-shaft gas turbines with their wide-speed range are used.

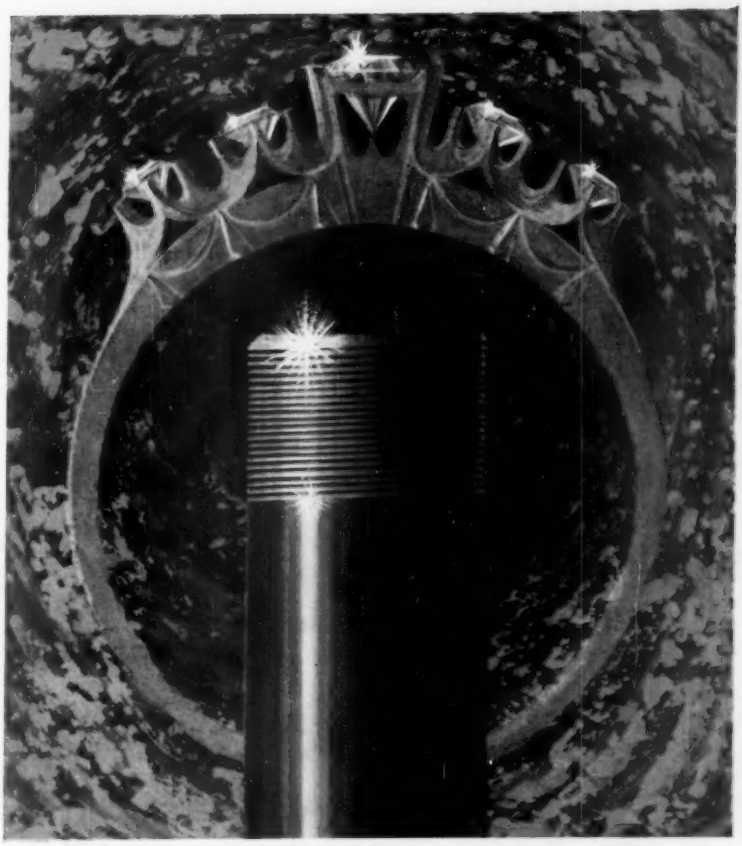
In some cases, a combination of one single-shaft turbine and one two-shaft turbine in a station would provide much more flexibility than two single-shaft turbines. The two-shaft turbine could vary its speed widely as necessary to allow successful operation of the single-shaft turbine. Even so, the operator may have to take special care to avoid troublesome shutdowns of the single-shaft turbine.

Fuel consumption. Under conditions of varying ambient and varying load, the two-shaft gas turbine with variable-load turbine nozzle shows significant fuel savings. In Fig. 7, specific fuel consumption is plotted against horsepower for the two units for 0° and 80° F.

The 0° and 40° F. performance of the two-shaft unit is very nearly the same and the 40° F. performance will be within plus or minus a few per cent of that shown except for maximum horsepower and limitations as seen from Fig. 6. Specific fuel consumption of the single-shaft unit is essentially independent of temperature and the 0° and 80° F. lines are the same except for horsepower limitations with ambient air temperature and the 40° F. performance can be estimated using the limits from Fig. 5.

Above 70% horsepower, the saving in specific fuel consumption averages about 1,000 B.t.u. per horsepower when operating at 40° F. and below. At 60° F. ambient, the saving would be about 500 B.t.u. per horsepower in this same range.

This performance difference is possible because the two-shaft gas turbine



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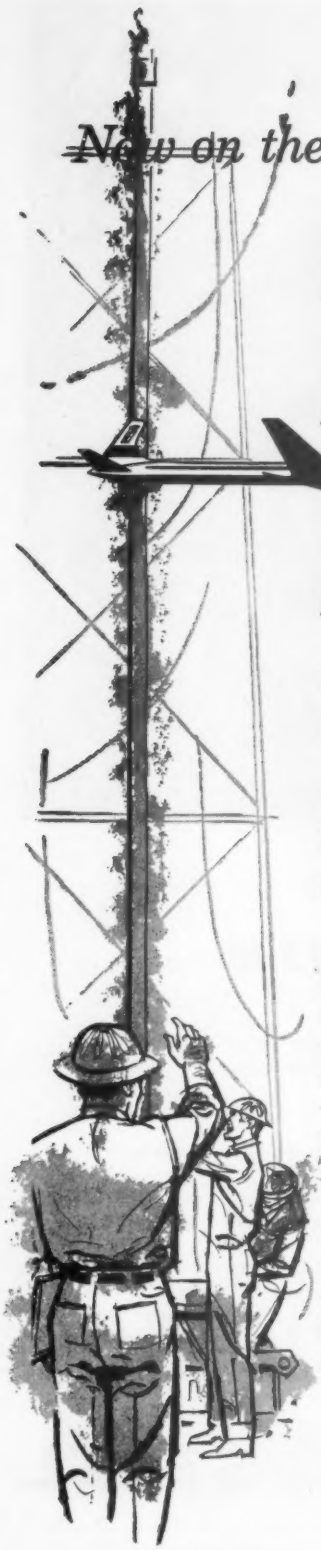

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with variable angle-load turbine nozzle can be controlled to reduce axial-compressor speed and hence air flow so as to maintain design turbine inlet temperature. This keeps turbine efficiency high. In a regenerative-cycle unit, a compounding gain in performance results because with reduced compressor speed, the temperature of compressor discharge air is also lower, and a more favorable temperature differential exists for heat recovery in the regenerator.

A quick approximation of a possible operation will illustrate what this performance difference can mean in fuel savings. With 7,600-hp. units, fuel gas at 30 cents per M.c.f., 50% of the operating time at ambients of 60° F. or less and 25% of this time at 40° F. or less, and averaging the 70 to 130% operating load range during this period as 100%, the savings in fuel cost per year amount to $7,500 per unit. Capitalized at rates used in the pipeline industry, this is equivalent to savings in installed cost of $50,000 to $60,000 for fuel before adding any penalty to the one-shaft unit for inefficient operation resulting from lack of speed range. Of course, other operating conditions than those assumed may increase or lower these savings.

NEXT WEEK:

Big Expansion in Underground Storage

NATURAL-GAS-STORAGE capacity has been increasing rapidly the past several years, and 1960 is no exception.

This is revealed in The Oil and Gas Journal's sixth annual survey on storage capacity in the U. S., which will be featured in next week's issue.

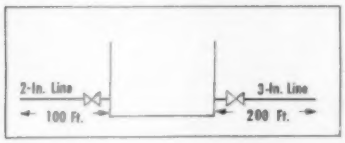
The new storage report lists capacities by companies and by states, and shows where the new projects are planned or under way.

It gives a breakdown of total reservoir capacity, working-gas capacity, and cushion gas for each storage area.

Watch for this up-to-date and complete picture of natural-gas-storage capacity in the Journal's May 30 issue.

Here are review questions and answers on fluid flow

In concluding the section of fluid-flow principles, here is a series of questions and answers to serve as a review for the first six parts of the section. The next few parts of this section will include more problems.



Δ P per 100 ft. in used steel pipe

G.p.m.	2-in. pipe	3-in. pipe
140	24.6	3.6
160	31.5	4.6
180	39.2	5.7
200	47.6	7.0
220	61.7	8.3
20	.7	.1
40	2.4	.4
60	5.2	.8
80	8.8	1.3
100	13.2	1.9
120	18.5	2.7
240	77.5	9.8
260	88.7	11.3
280	101.0	13.0
300	. . .	14.8
320	. . .	16.6

Neglecting P of fittings

QUESTION 1a: What will be the approximate flow rate through the 2-in. and 3-in. lines when both valves are opened and the water level in the tank is 50 ft.?

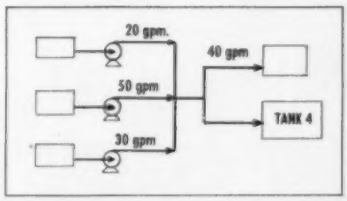
ANSWER 1a: Pressure at bottom of tank is 50 ft. × .433 psi./ft. = 21.65 psig.

Pressure at the end of the pipe is atmospheric or 0 psig.

Then the pressure drop available to drive the fluid is 21.65—0 or 21.65 psi. For the 2-in. pipe this corresponds to 130 g.p.m. and for the 3-in. pipe, 250 g.p.m.

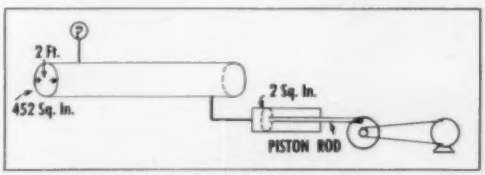
QUESTION 1b: What will be the approximate rates when the water level has dropped to 10 ft.?

ANSWER 1b: Pressure available to drive the fluid is 10 ft. × .433 psi./ft. = 4.33 psig. This corresponds to 50 g.p.m. for the 2-in. pipe and 110 g.p.m. for the 3-in. pipe.



QUESTION 2: What is the flow rate into Tank 4?

ANSWER 2: 60 g.p.m.



An exchanger shell is being pressure-tested with water by using a small reciprocating water pump.

The end of the piston in the reciprocating water pump has an area of 2 sq. in. The head on the exchanger is flat and is 2 ft. in diameter and, therefore, has an area of 452 sq. in. After the shell is full of water, the motor will develop a maximum push (force) down the piston rod of 300 lb. before it stalls. As the motor stalls . . .

QUESTION 3a: What will the pressure gage on the exchanger shell read in psig?

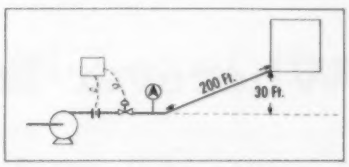
ANSWER 3a: Pressure is transmitted equally throughout a static fluid. The gage will read 150 psig.

Pressure = Force/Area = 300 lb./2 sq. in. = 150 psi. on the head of the piston.

QUESTION 3b: What will total force on exchanger head be in pounds?

ANSWER 3b: Force = Pressure × Area.

Force = 150 psi. × 452 sq. in. = 67,800 lb.



The pressure drop in 2-in. pipe per 100 ft. for 200 g.p.m. of water is 37.5 psi. The pump can pump 200 g.p.m. at 150 psig. A flowmeter and control valve control the flow to 200 g.p.m. The pump is pumping water (each foot of water = .433 psi. of static pressure). The distance from pressure gage A to the tank is 200 ft.

QUESTION 4a: What will pressure gage A read when the tank is empty (but line is full)?

ANSWER 4a: The pump will have to develop enough pressure to overcome both the static head in the line and the pressure drop through the line because of friction.

Static head = 30 ft. × .433 psi./ft. = 12.99 psi.

Pressure drop through the line = 37.5 psi./100 ft. × 200 ft. = 75 psi.

75 + 12.99 = 87.99 psi.

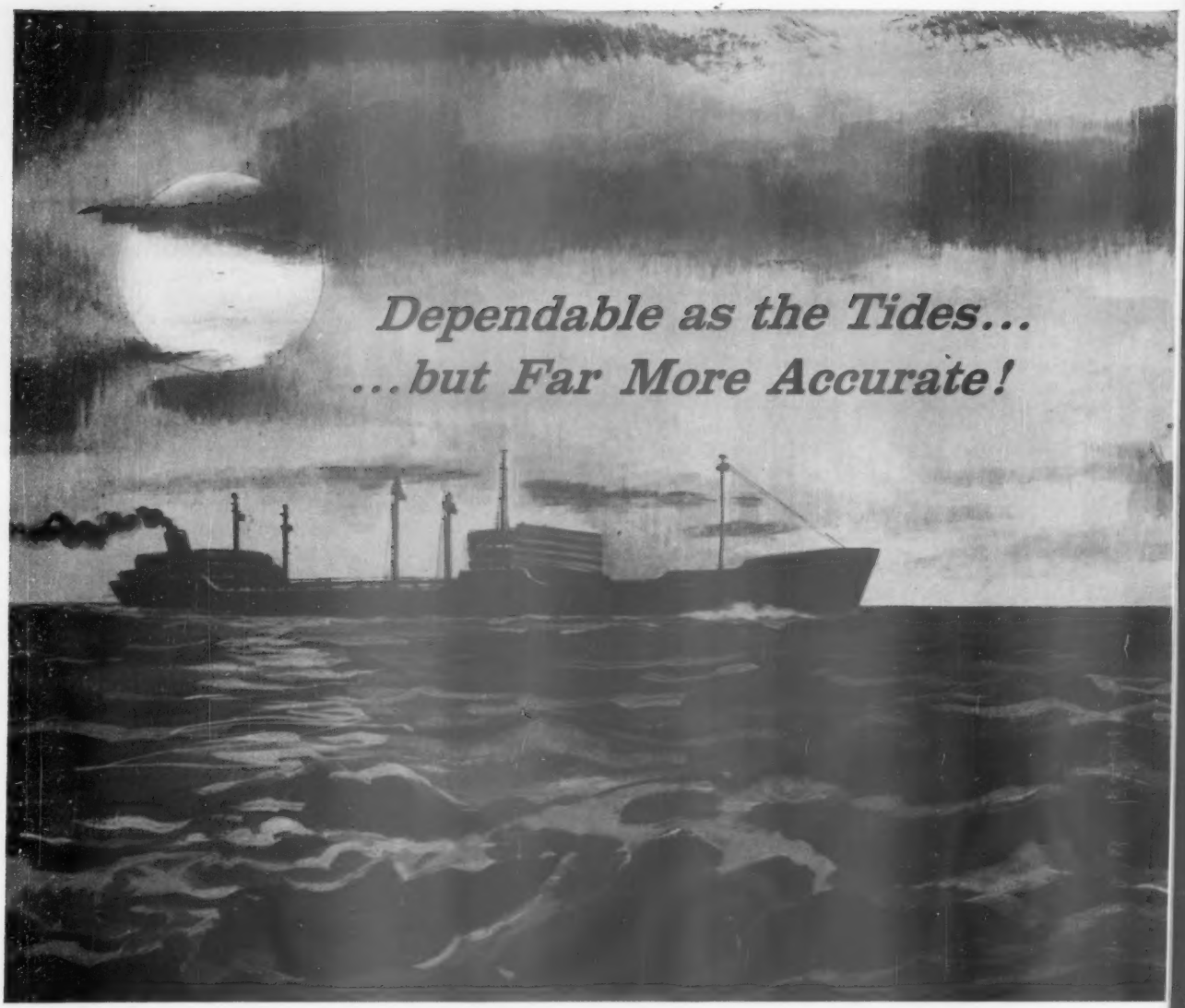
QUESTION 4b: What will pressure gage A read when the tank has 40 ft. of water in it?

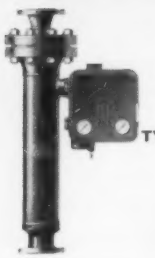
ANSWER 4b: The height of water is now 70 ft. above the pump discharge.

Static head = 70 ft. × .433 psi./ft. = 31.31 psi.

Pressure drop through line = 75 psi.

31.31 + 75 = 106.31 psig.





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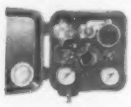

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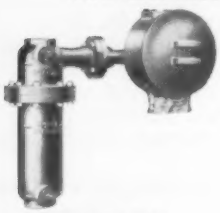

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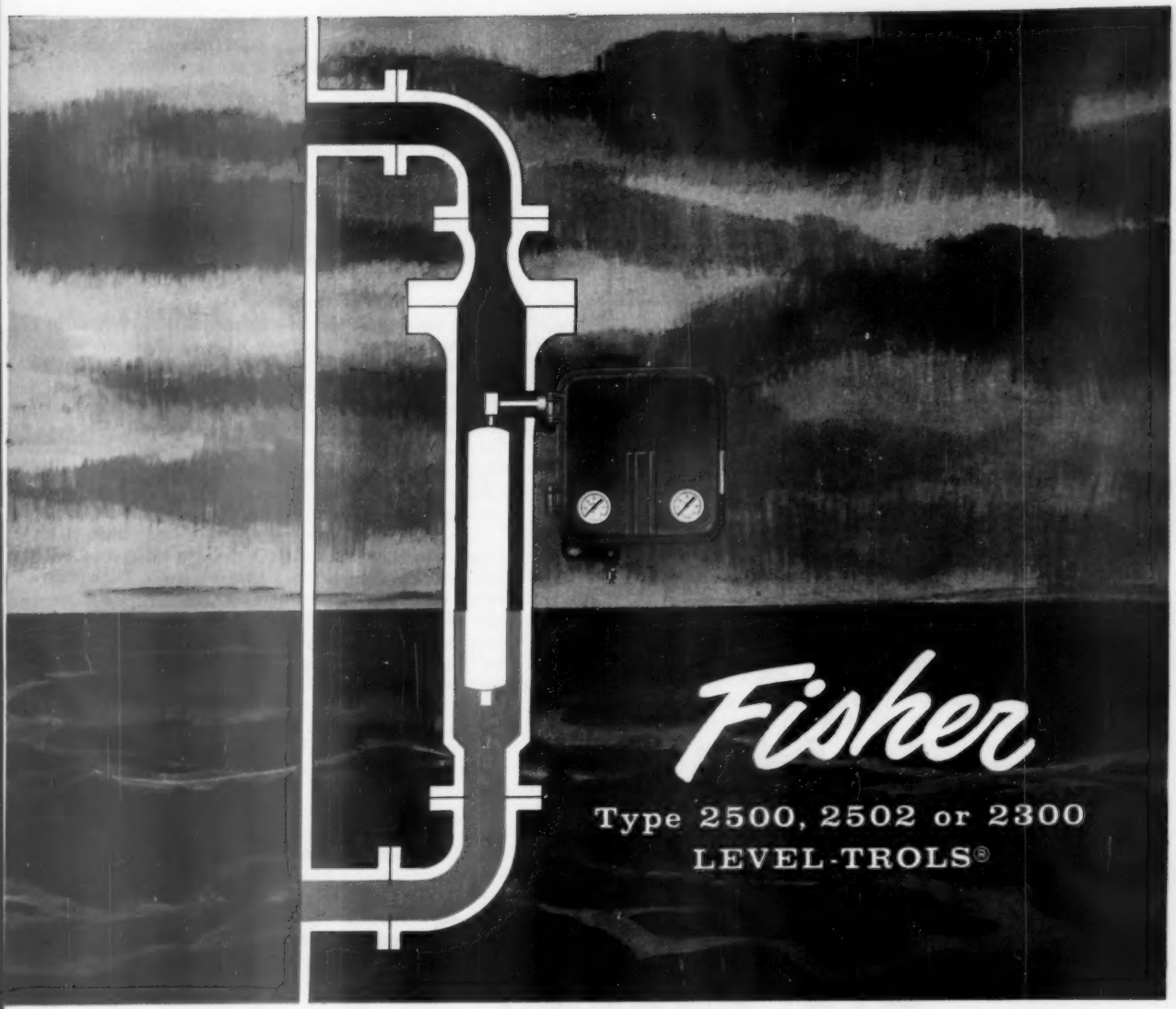
The basic simplicity of the design makes the operation of these controllers virtually friction free and accounts for the great popularity they have achieved throughout the industrial world; particularly in the process and power industries.



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Check list keeps RIG SAFETY on its toes

BY BOB SMITH
Drilling Foreman, Miller & York Drilling Co.
Bakersfield, Calif.

NOTHING ELSE PAYS OFF for a drilling rig quite like a good, working safety program. Yet one of the hardest things to do is to **keep** the men thinking safety.

In our company's effort to build rig safety, I feel that we have worked out an effective program. Basis of this program is to interest each crew member in proper maintenance of the equipment he works with. To do this, we have essentially a two-part approach:

1. We use a maintenance check sheet which must carry each man's signature showing that he has checked that part of the equipment which is assigned to him for inspection.

2. We couple the instructions to be followed in the inspection and reporting with an explanation of the economics connected with it.

Let me first outline this "explanation of economics" since I have found it one of the most effective means of keeping the crews interested in the program. We inform the crew of the cost of materials and the cost of damage that may result from failure of equipment. Then, we relate this to their pay checks.

For example, you can show a crew that one minor disabling injury can mean the difference between being able to keep that crew on, on a day when the rig is idle, or being faced with the necessity of laying them off. This brings the business of maintaining the rig and preventing accidents down to the point of protecting themselves and their pocketbooks. Self-protection makes safety a much more important issue to each member of the crew.

On check list. The maintenance check sheet mentioned above is filled out on the man's first tour back after days off. This provides us with an inspection report of all equipment on the rig every 2 or 3 days. Among other items, this check sheet shows the condition of catheads, guards, floor, hard hats, goggles, fire extinguishers, escape line, safety lines, the general condition of the rig and the location, the mud pumps, and the mud system. The check also records whether or not each crew member is equipped with steel-toe boots.

This is only the basic premise on which I attempt to build interest in safety on the part of my crews. All hand tools on the rig are periodically inspected and we insist that they be kept in their respective places. During the time I have drilled for various contracting companies, it has made me shudder many times to walk on a rig floor in relieving another crew, and find hand tools scattered about the floor and on the rotary table when the crew had been in the process of making a trip.

Accidents?—Yes, it seems as if they were not getting anything done if someone was not injured or some piece of equipment on the rig was not torn up. Safety meetings?—That was a waste of time.

Within our program to maintain interest, we have a safety meeting set up once a month. We review the accidents that occurred in the past month, both large and small, to see if there is a way to prevent a recurrence. In some of these meetings we show motion pictures which graphically describe ways of performing a job with greater safety.

Frequently, we have a representative from one

of the tool companies present the crews an instructive talk on handling their tools and products with the greatest degree of safety and to their greatest advantage.

Within these safety meetings, safety awards are given at the end of each year for the best safety records on the rigs. This helps greatly to create a desire to keep down accidents and to keep tools and equipment in the best possible repair and in their proper places.

Making mast safe. In maintaining the mast itself, we manaflux pedestals and starting legs, bridle, and other vital points of the lifting mechanism periodically. Each time the mast is lowered, a tool pusher and at least one driller inspect the mast for broken or bent braces and girts. If any are found, they are replaced.

After the rig is moved and the mast reassembled, ready to raise, it's again inspected by a tool pusher and at least one driller to make sure no damage was done during the move. Again, if bent or broken braces or girts are found, they are replaced before the mast is raised.

All sheaves and bearings in the crown and traveling blocks are inspected for wear on each move. Guards on the crown block are inspected to make sure a line cannot jump off the sheaves.

Not only does this inspection tend to guard against major accident occurrences, it also shows if line lubricant has piled up on the crown block. If it has, this tarry lubricant is removed before the mast is raised so that chunks of it never fall from the crown to the floor. This inspection and check for lubricant buildup is also an opportunity to note whether sheaves are worn and whether the line is properly seating in the sheave at all times.

Safe line a must. On rigs where I have worked, I have often asked the tool pusher what his drilling-line cutting and slipping procedure is. Frequently, his answer would be "cut and slip it when you think it needs to be. Change it when you think it should be changed, that is, if you're afraid of it."

Well, I'm afraid of it. What kind of procedure is this! How can anyone know if he is getting good service from the drilling line he is buying or if the line is still safe to work under? A drilling line may not show severe wear on the outside, and yet may be worn to an unsafe point where it cannot be seen.

I believe every rig should have a drilling-line move program. The size and length of line and the diameter of the sheaves help determine the ton-miles you will receive from a line. I have been told that some rigs get better service from a hemp-center line and others from a steel-center line. Undoubtedly you could get good arguments on either side; however, an established ton-mile program gives a pusher a definite guide to safe line service.

At the same time, we must all remember that we cannot depend upon a ton-mile program to the point of refusing to give the line careful visual inspection. We must also remember that many factors affect wire-line strength; we must take these factors into consideration when we are fishing, running casing, or when unusually rough drilling causes bit chatter and transfer of severe vibration to the drilling line.

Trouble from dead man. One thing I have learned from experience: each time the drilling line is moved or cut, it is essential to check the dead man anchor. The line must have been properly secured and the retaining bolts put back in the ancher. Not too long ago, a crew moved its line and then started into the hole. I noticed there was a sudden stop with the blocks. I thought at the time I had better check the dead-man anchor.

Sure enough, when I checked it, the retaining bolts had been left out and the line was outside the anchor spool and across the flange. Fortunately, there was not yet enough pipe in the string that weight was cutting the line.

On our present rig, the dead-man anchor sits at a slight angle away from vertical so that the retaining bolts can be slipped in from the uphill side. And, unless there is excess vibration, they will remain in place. Several times I have found that the crew, after a move, has slipped these bolts back in from the downhill side without putting a retaining nut on the bolt. Result is that the bolts very quickly drop out when normal operations are resumed.

Lines on floor. Another vital point of inspection are the utility lines on the rig floor. Tong lines, spinning line, the connectors for the spinning line, cat line, and high line, should all receive close attention from every man on the rig; failure of any one of these while under load can cause a serious personal injury. With the high line and cat line especially, there may also be serious equipment damage.

Peddlers, pushers. We use one additional means of giving impetus to our maintenance program: we call upon engineers from various service companies to help by inspecting equipment on the rig. Some of these inspections and reports are fee services, some are provided to us free by the companies involved.

To keep rig personnel constantly interested in safety, the pusher has a great responsibility. He must, first of all, see that the program is carried out; he can at no time allow "dog-housing" of reports. In turn, and supplementing the reports of the crews, the pusher must make a report of an inspection made in the company of one or more drillers. The report is made in triplicate and is countersigned by the driller or drillers accompanying him.

In addition to seeing that the inspections are made, the pusher, of course, has a responsibility to follow up and correct unsafe conditions or equipment reported on the rig.

Coming June 6:

Special World-Wide Report on Offshore Operations

THE TECHNOLOGY and economics of offshore operations will be featured in a special Journal report June 6. Highlights will include:

- A study of the economic pressure being felt by operators and drilling contractors off the coast of Louisiana and Texas, and how it's going to be counteracted.
- A new international roundup of active offshore areas outside the U.S.
- An analysis of underwater completions, and the techniques used on platforms and floating drill barges.
- A timely report on horizontal control methods for laying offshore pipelines.
- An up-to-date look at exploration in Lake Erie.

Watch for this special offshore coverage in the Journal's June 6 issue.

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Oil may find tough sledding in plastics

• Observing petroleum's move to plastics, some chemical veterans seriously question whether oil can ever rise above second rank in this fast-paced field. The answer seems to lie in divorcing the chemical-plastics division from petroleum operations and thinking.

BY WALTER J. TALLEY, JR.
Associate, McKinsey & Company, Inc.
Management Consultants

The author was quality control supervisor with Du Pont, senior market analyst with Pure Oil, and supervisor of sales analysis with Amoco Chemical before joining the management consulting firm of McKinsey & Co., Inc., Chicago, as an associate. He has a BS in chemical engineering from Northwestern University and an MBA in marketing from University of Chicago.

HALF HIDDEN in the recent flood of announcements of intentions to build or actual openings of new plastics plants across the country, is another equally important trend. Over the long term it promises to shake parts of the chemical industry; it will likely affect those petroleum companies involved even more. The development: A concerted move by major petroleum producers into the burgeoning plastics field.

Major oil moves. Over the past year, five petroleum giants have made these steps:

- Standard Oil Co. of New Jersey, through Humble Oil, went into polypropylene.
- Shell Oil Co. moved to produce polystyrene in an idle American Cyanamid plant.
- Standard Oil Co. of Indiana started into polystyrene via its Amoco Chemicals subsidiary.
- Sun Oil Co., through 50% interest in AviSun, began commercial production of polypropylene.
- Gulf Oil Corp., through Goodrich-Gulf, began construction of high-density polyethylene facility near Port Neches, Tex.

In so moving, these five oil companies joined Phillips which has had a 75-million-pound high density polyethylene facility at Pasadena, Tex., for several years.

The move to end-product plastics represents a major departure for these oil companies from the position of supplier of raw materials to chemical and plastics producers. Only Shell Chemical has made previous efforts in end chemicals. Now, all five are moving into direct competition with customers. Other oil concerns will likely follow.

These steps represent impressive financial commitments. Each of the above moves could represent outlays of $100 million over the next 5 years—plus more later. They also spell entry by oil companies into a new, tough, and entirely different kind of business. And, there is some question whether oil companies can make the grade in this new field.

The obvious attraction to petroleum companies in the move is the growth and profit potential in plastics. Over the next 10 years, U. S. plastics production is expected to grow at least by 9.5% per year. This means last year's 5.6 billion pounds will grow to some 14 billion pounds per year in 1969 and some believe it could reach 20-25 billion pounds. The best time to manufacture an item is during the ebullient first half of its product life cycle; therefore, petroleum concerns are rushing in to get their hoped-for share of market and profits early. They count on their financial strength, the fact that the market is fast growing, and an early foothold as suppliers of basic chemicals to secure position. If they do well, you can expect to see them gradually diversify into broader and broader lines of chemicals and plastics.

Just how well the new petroleum entrants do will depend upon their agility, and on established plastics producers' reactions. Veteran operators such as Union Carbide, Monsanto, Dow, Du Pont, and Goodrich Chemical will not move over for any upstarts.

At first, no basic change. Petroleum companies are already major suppliers of basic chemicals. The five large oil companies mentioned above, for example, boast total capacities of 1,470 million pounds of ethylene, 142 million gallons of benzene, 140 million pounds of styrene monomer, and have 320 million pounds of high-purity propylene capacity under construction. These early moves to basic petrochemicals production involved no drastic change in outlook or in operation.

When a number of major oil companies moved into petrochemicals after World War II, they did so more to increase the value of a barrel of crude than to tap a new market. The purification of such products as benzene or ethylene, for instance, is an essentially refinery like operation and the distribution of products is simple. The market for basic petrochemicals consists of a very few large chemical concerns, with key factors in sales being price, plant location, and trade relations.

However, by moving into end-chemicals and plastics, petroleum companies are entering a different arena. Just how different, you can tell by some comparisons.

Petroleum versus plastics. For one thing petroleum has a much different tempo from that of plastics. The decision to develop a major oil field or a new geographic market, for instance, can be studied and gradually implemented over a number of years. With standardized products and great financial resources, looking as they must 10 to 20 years ahead for capital-development programs, and assured that their

chemicals on the move...
in petroleum

Truly exciting is the prolific field of petroleum refining. In addition to new high-octane fuels and improved lubricants, many new plastics, paints, dyestuffs, detergents and drugs owe their origin to petroleum. Rapid developments have brought new demands on the petroleum industry's chemical suppliers... created new challenges.

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CHEMICALS DIVISION, BALTIMORE 3, MD.

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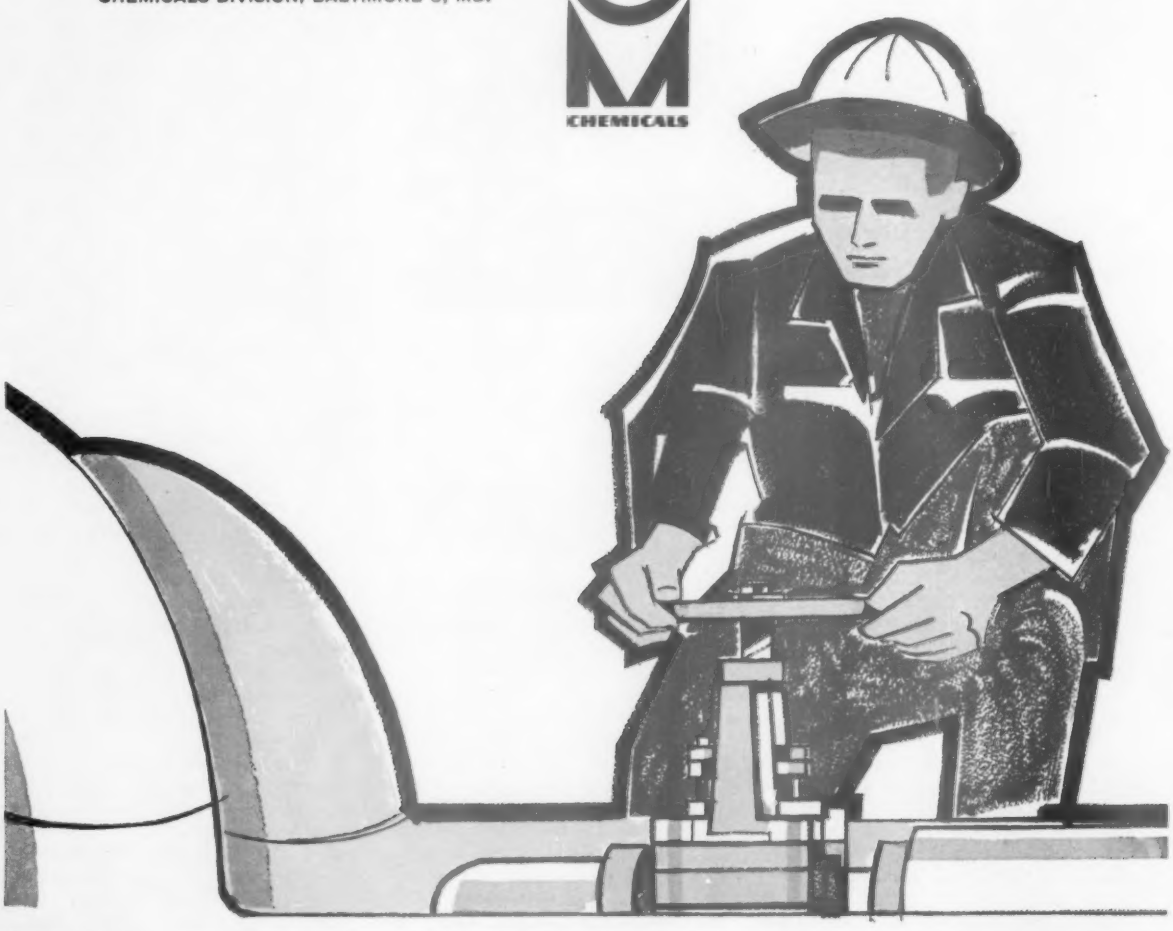

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long-term market is firm, large oil companies have been able to move with deliberation. In plastics, on the other hand, more than 50% of the products being made today did not exist 10 years ago. Here, obsolescence, which can occur in from 5 to 10 years, is not so much a risk as a certainty; change is constant, and the pace of investment decisions rapid.

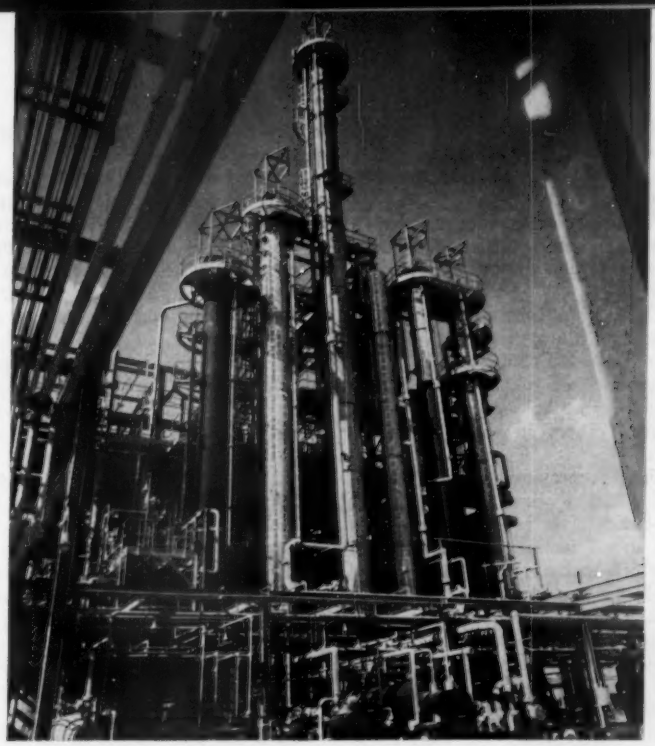
There are important similarities in the petroleum and plastics industries in that they are characterized by giant corporations with hundreds of millions of dollars invested in plant and equipment. Also, both industries have sales potentials in multibillion-dollar ranges. But, where oil reached the billions-of-dollars mark years ago, plastics are just getting there, and key differences between petroleum and plastics extend from manufacturing through product characteristics, marketing, and research.

Manufacturing operations in the two fields are different. In oil, high-volume operations are a necessity and the norm. Oil technology is fairly stable; new petroleum refineries tend to be bigger and more complex versions of former refineries with consolidation and more efficient operations the primary goals. In plastics, short-run, tight quality operations are common; technology is in flux; and plants differ greatly. A phenolic plastics facility, for instance, is entirely different from a polystyrene plant; a polystyrene plant differs from a polyethylene plant.

As to product characteristics, the giant petroleum industry depends on a relatively simple product line, primarily gasoline, lubricants, and fuel oil. There have been many product improvements but no basic product changes. The plastics industry, on the other hand, is marked by sharply changing products that compete with natural products and with each other. Besides replacing nonplastic materials in many applications, polyethylene and polypropylene, for instance, have opened up entirely new and sometimes competitive markets for themselves.

Marketing tells a like tale. Petroleum products are sold to end users who do not further process, but who directly consume, a standardized product. With gasoline and lubricants supplying secondary demand tied to the use of automobiles, marketing has tended to concentrate on the most efficient disposal of a stable product line.

Plastics, however, are still evolving. Semiexperimental products are sold to highly discriminatory customers who further process the material into end products. Successful marketing calls for aggressive technical selling, backed by very active, and highly expensive, service laboratories working on product improvement and new-product applications. In other words, in petroleum, marketing has been keyed to filling a demand for products, while in plastics it has "created" demand.



PETROLEUM and plastics industries are similar in that they both have hundreds of millions of dollars invested in plant and equipment. Fig. 1.

Then, in research, although both industries have done a great deal of important work, the orientation has been different. By and large, petroleum research has emphasized exploration techniques plus improving quality and process development. Oil companies do little of what established chemical concerns would call basic research.

And finally, both at the producing and distributing end of their integrated operations, oil companies are subject to a certain amount of governmental interference.

Can petroleum make the grade? It is this combination of differences that, in the eyes of some chemical-industry veterans, rules against petroleum companies ever rising beyond the second rank of plastics producers. They hold that:

- Petrochemical companies are too closely geared to toplevel petroleum thinking; that oil-company boards of directors are handicapped when asked to make decisions on chemical and plastic ventures without knowledge and experience of the complexities of chemicals.
- Petrochemical problems get attention at the top level only after pressing petroleum problems have been solved; and when major decisions are made, they are developed at the slower petroleum pace.

"When the rest of us are working on something new the petroleum-petrochemical companies will still be slicing prices and working the low margin end of polyethylene and polypropylene," predicts a chemical marketing man.

In part this last comment also has to do with research. Chemical companies tend to feel that petroleum companies have yet to prove they can do the creative basic research necessary to develop new plastics,—or that they can make effective use of the research they do turn out. Two major oil companies that were in a prime patent and know-how position 10 years ago in polyethylene and polyvinyl chloride, for instance, never managed to take effective advantage of this lead.

"Add to this that they lack operating management with plastics experience, they lack marketing men familiar with plastics selling or pricing, and they lack technical-development people to back up their salesmen," says a chemical-company executive. "Oil companies are too engrossed in the process of getting a barrel of crude out of the ground and racking up depletion allowances. When they get into plastics they want to turn on the faucet, pour out the product, and use up lots of crude. Together, these points mean

the oil companies will play second fiddle in plastics," he concludes.

However, there is another brighter side to this coin:

- Petroleum companies are just breaking into plastics; it is only natural that they trail the veterans.
- Their giant size and dollar strength allow them to ride out a long development period.
- Experienced management can be developed, as well as acquired from others in the plastics industry.
- Finally, previous successful production of basic chemicals for plastics gives petroleum concerns a sound technical foundation on which to build, and their control of raw material permits them to take an integrated position.

In toto, in spite of any factors, pro or con, the point remains that the oil giants are moving into end-product plastics for keeps. Aside from the attractions of growth, there are a number of short-term and long-term obvious and subtle pressures for this move.

Oil companies may have first moved into basic and intermediate petrochemicals to increase the dollar value of the barrel of crude, but they stayed to make money in chemicals. This has not proved easy. They found margins becoming increasingly narrow, and the ease of entry of other petroleum companies into the field further aggravated this situation. Price fluctuations were painful and the threat of large chemical customers integrating backwards to produce their own raw materials was always present.

For example, Du Pont's recently announced move to integrate back to the manufacture of acrylonitrile, used to manufacture orlon, is likely to drive some acrylonitrile producers out of the market. An obvious answer to those problems was to integrate forward.

Then too, the petroleum industry, which has been growing almost automatically over the last 30 years, now shows signs of slowing a bit. One such sign is economists' forecasts that fast growth of the automobile market is going to taper off, another is the lower gasoline consumption of the new compact cars. In the future loom the fuel cell and atomic energy, which may challenge petroleum's position as a basic energy source.

With big financial resources, cash generated in large amounts, and an eagerness to maintain growth, oil companies look to diversification. The fact that they have a foothold via basic and intermediate chemicals makes the move to plastics almost inevitable.

Criteria for success. Some of these oil-company plastics producers will do well. A number will not, and the differences between top and second-rank companies will be obvious. As they evolve, leading petrochemical plastics producers will look more and more like the independent chemical concerns with which they compete; less and less like their oil company parents.

That is because recognition that plastics and petroleum are two very different kinds of business is one of the main criteria for success. Petrochemical companies that do well in plastics will be tied in to their parent oil companies only at two ends, at the basic refinery process and at the very top via the board of directors. The rest of their manufacturing, distribution, development, and control systems will be independent and nonpetroleum oriented. The most successful petrochemical companies in plastics will conduct their own research, set their own operating budgets, and establish their own long-term objectives independently from their parent oil companies.

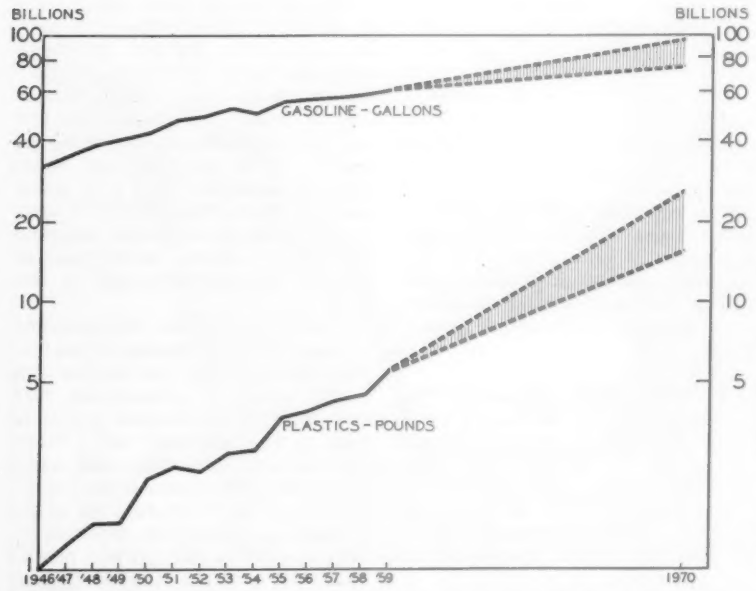
Separate, but interlocking boards of directors for related plastics and petroleum companies are also a probability.

Meaning to management. This theoretical ideal is not going to appear full blown upon the scene; it is a goal which petrochemical companies moving into plastics must keep in mind. And for management of parent petroleum companies, it has special meaning.

To set up an independent operation with funds, personnel, and objectives separate from those of the parent, and then to actually let it work on its own or even to prod it into going off on its own takes a certain amount of courage. There is a world of difference between saying that an operation is independent and seeing to it that the activity really does operate on its own.

The job of separating previously united operations is very difficult. The mere establishment of a separate petrochemical research operation, for instance, does not guarantee that effective or really independent research activities will be carried on. What have to be changed are the attitudes, methods, pace of thought, and, sometimes, personnel of the organization.

Those petroleum companies that do manage to separate their petrochemical-plastics operation sufficiently from the oil business will have done so only after intensive study and a certain amount of soul searching. These companies will first have studied the plastics field to determine what products they can or should develop. They will have realistic objectives as to share of market and rate of growth they expect. They will appoint competent personnel to head the new project and give them the authority and finances to do the job. Most important, they will evolve a time schedule and specific criteria against which the new business' performance can be judged, but will otherwise divorce petroleum from plastics.



SKYROCKETING growth of plastics compared to leveling-off trend in gasoline production is a prime factor in petroleum's move to plastics. Fig. 2.

BY W. L. NELSON
Technical Editor and
Petroleum Consultant

ATRS schedule becoming more widely used

We see figures above and below USMC and ATR tanker rates in The Oil and Gas Journal, but what do these mean? When we see shipments from the Middle East at minus 75% and shipments from the Gulf of Mexico at only minus 32%, does this mean that the Middle East rates are less than half the Gulf rates, or what?—A.G.T.

No, the difference is not as great as the rates indicate. The matter of relative tanker rates is extremely complicated. However, we do have various Standard Rates that indicate with reasonable accuracy the costs of tanker transportation for various routes. These standard rates (USMC, SCALE, ATR, etc.) must be accepted as properly representing the relationship between various routes, or we have no basis at all for comparison. The Standard or Basic rates have been compared on two issues of this page (New American Tanker Rates, Dec. 21, 1959, p. 83; and SCALE and USMC Tanker Rates, Aug. 20, 1956, p. 241).

However, the situation is complicated further by the fact that the rates for some routes are normally lower (or higher) than for others because of (1) the nationality of the owner or the crew, (2) larger faster tankers are used more frequently on some routes than on others, (3) there is a tendency to accept a lower percentage profit on long-distance shipments, or in the extreme (4) an owner may decide it is cheaper to operate temporarily at a very low rate, rather than to lay-up the vessel. Thus, when shipments from the Netherlands West Indies (NWI) to the U. S. North of Cape Hatteras (USNH) are occurring at their Standard USMC rates, the rate for Gulf-USNH shipments will (on the average) be about 15% higher than the Standard rate for Gulf-USNH or at USMC + 15, whereas shipments from the Middle East to USNH will be occurring at USMC − 23 (approximately). The same sort of a relationship between various actual rates continues to exist even when the rate for the NWI-USNH run is not Standard, but is at some "plus" or "minus" based on USMC.

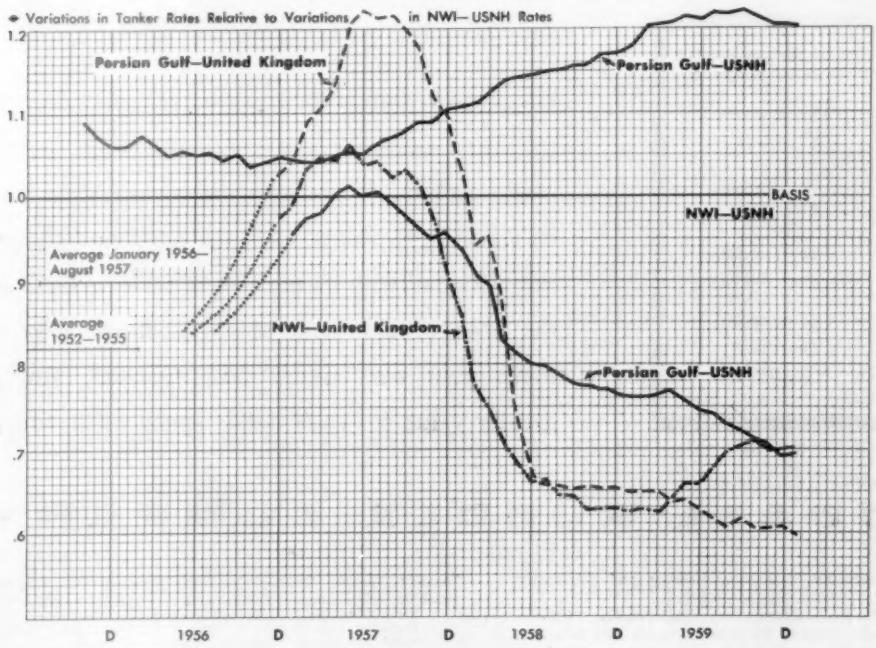
These general relationships, using the NWI-USNH run as a basis for comparison, are shown in Fig. 1. Gulf-USNH rates have been consistently higher than NWI-USNH rates since at least 1956, and the long-distance rates have been lower except during the Suez crises of late 1956 and extending through 1957.

Fig. 1 was obtained by computing the average tanker rates (from the "spot" rates published each week) as "plus" or "minus" the respective Standard rates, using the method outlined in the Oct. 21, 1957, issue of this page. The average rates (plus or minus USMC) were then divided by the average rate for the NWI-USNH run of the same date. As an example, the average rate of May 1958 for NWI-USNH was USMC − 27%, and on the same date the average rate for Gulf-USNH was USMC − 16.6%. The actual rate for the Gulf-USNH run was 14.2% higher than for the NWI-USNH run:

$$\frac{100 - 16.6}{100 - 27} = 1.142$$

In connection with SCALE rates it was also necessary to convert to an equivalent USMC Standard rate as outlined on this page (Aug. 20, 1956, p. 241).

Finally, if the Standard rates are corrected by the ratios indicated in Fig. 1, it is then possible to use a single "plus" or "minus" value based on the corrected Standard rates for all shipments whether from the Netherlands West Indies, the Gulf, or any place throughout the world. This is, of course, an approximation because the ratios of Fig. 1 must be averaged for each route.



RELATIVE COSTS of tanker transportation for various runs (corrected for distance). Fig. 1.

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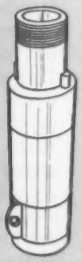
These exclusive features are available *only* with Goodall Long-Life Rotary Hose:



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Available through all qualified supply stores.

▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .

New lightweight synthetic rope

A NEW ROPE promises to make it easier to pull overhead electrical conductors on transmission and distribution lines. Called Pengo-Prope, it handles and splices in the same way as manila, but because of its greater strength, smaller diameters can be used, the maker says.

Features cited for the rope include: (1) excellent dielectric characteristics, (2) waterproof, (3) not adversely affected by salt water, (4) can be left in the weather as it will not mildew, (5) strong and lightweight, and (6) suited for tension stringing. Delivery: about 2 weeks. Source: **Petersen Engineering Co., Inc., 460 Kifer Road, Santa Clara, Calif.**

Space saved

. . . with tubing valve recently developed that is capable of handling liquids and gases at 12,000 psi. The SpaceSaver valve has large port openings and can be quickly installed, according to the maker. No threading, swaging, flaring, welding, or special tools are needed, the maker says.

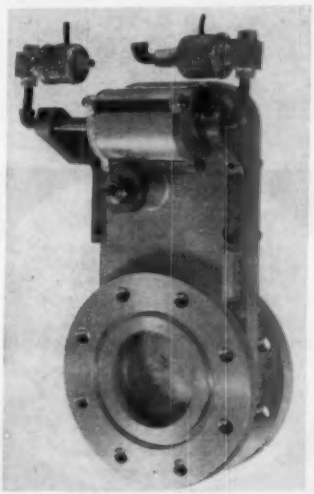
The valve uses Type 316 stainless-steel construction and comes in sizes for ⅛, ¼, or ⅜-in. o.d. tubing. Delivery 2-3 weeks. Approximate price, f.o.b. facory: from $12.35 for a ⅛-in. to $14.50 for a ⅜-in. valve. Source: **Autoclave Engineers, Inc., 2930 West Twenty-second, Erie, Pa.**

Air-operated control

. . . is now available for a line of high-vacuum gate valves. The device is designed to effect 180° of rotation of a valve stem, but promises to be useful for a variety of similar control applications. According to the maker, it is compact and fast in operation. Closing time is less than one-fifth second at available pressures, the maker claims.

The operator is based on a rack-and-pinion principle. The piston is fixed and the cylinder carries the rack. Air moves the cylinder to turn the pinion gear mounted on the valve stem. The operator can read the position of the gate at the valve location, or remote indicators can be easily installed.

If power fails, the control can be operated manually. Two solenoid actuators are normally used to retain the desirable feature of hand operation when needed. But the device can also be operated with hand-operated air valves, or solenoids with larger ports may be used to affect



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greater speed or to accommodate higher line pressure. It can be set to open or close when power fails. Delivery: immediate. Approximate list price, f.o.b. factory: $70. Source. **Vacuum Research Co., 420 Market Street, San Francisco 11.**

●

Air cools

. . . electrode holder available for heavy-duty metallic arc welding. The holder will handle electrodes through ⅜-in. diameter and is rated at 600 amp. at 40 volts and 60% duty cycle.

According to the maker, the air-cooled unit lets a welder weld a full shift without changing holders and does away with the hazards and complications of water-cooling. Air at low pressure flowing from perforations in the handle cools the holder and the operator's hand. The holder is a lever-action semi-insulated type with straight jaws. The complete unit includes a 6½-ft. neoprene-encased cable whip and Y-connection with air inlet brazed into a twist-and-lock electrical connector. Delivery: immediate. Approximate net price, f.o.b. factory: $29.95. Sources: **J. B. Nottingham & Co., 441 Lexington Avenue, New York 17.**

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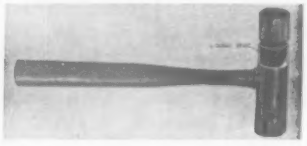

"No-bounce" hammer

. . . has an aluminum head with two separate cavities which are permanently loaded with loose shot to do away with rebound. The hammer has a screw-on replaceable plastic tip made of ethyl-cellulose. The two separate shot-loaded cavities permit handle replacement, if ever necessary, without loss or spillage of the shot, according to the maker.

The hammer has a hickory handle held in place by a plastic bushing. Delivery: immediate. Approximate list price, f.o.b. factory: $5.60. Source: **Metocraft Alloy & Plastics Co., 1039 Memorial Avenue, West Springfield, Mass.**

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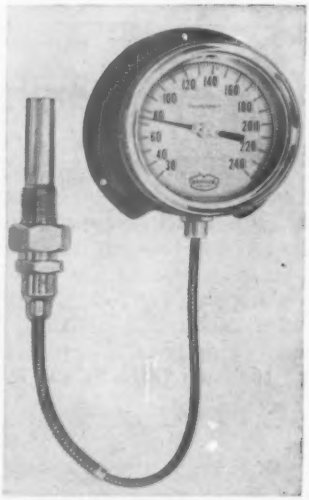

Dial thermometer

. . . being produced for piping installations is mercury-actuated, easy to read, and provides dependable accuracy through the working range, the maker claims. It has a uniform graduating scale and is enclosed in a black-enameled aluminum case with chrome-plated slip ring. It comes with a brass separable socket and extension neck. It is also available with a fully compensated line up to 200 ft. long.

The socket is interchangeable for ½, ¾, or 1-in. N. P. T. in 3½ and 6-in. extension-neck types. Sizes: 4½, 6, and 8½-in. dials. Ranges: from −20°/100° to 100°/400° F. Delivery: immediate. Approximate price,

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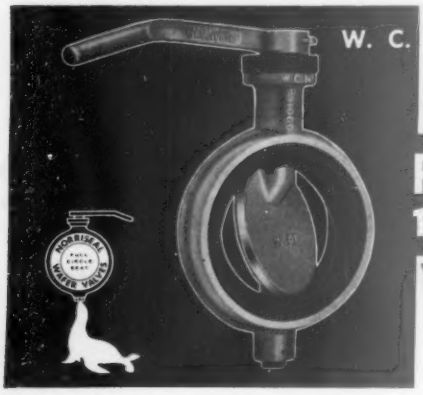
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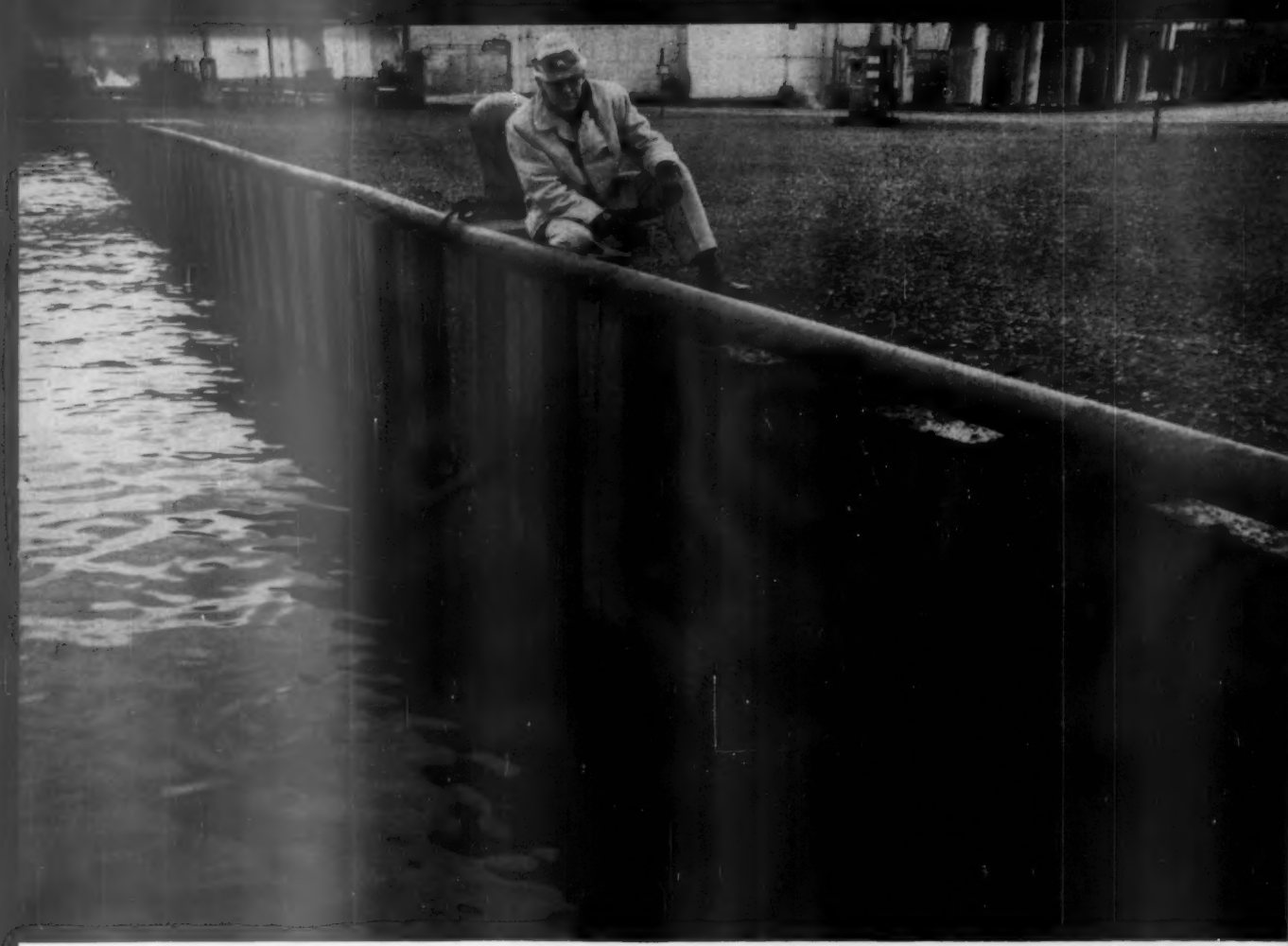

At Cities Service Oil Company's Rahway, N. J. refinery

Bitumastic Coatings outlast costly materials on tough, tide-zone piling protection

The Cities Service refinery's docking area is located on the Arthur Kill, a salt water channel with a high content of industrial wastes and debris that presents a tough corrosion problem. That's why special attention was given to the protection of sheet steel piling at the wet-dry zone.

Two types of coating systems were tried, both over sandblasted steel; one, a new type of coating using "exotic" materials, and the other, a combination of two Koppers coatings: Bitumastic® No. 50 and Bituplastic® No. 28.

Within six months, the more expensive coating was badly deteriorated, and had to be removed, while the Bitumastic coating system was still in excellent shape—and is now protecting *all* the piling. The combination of heavy-duty undercoating given by thick, tough Bitumastic No. 50 and the sunlight and water-resistance of Bituplastic No. 28 over this base was the happy answer to the specific conditions.

The right answer to many corrosion problems can be found among the ten Bitumastic coatings, since they offer a wide variety of characteristics to suit many applications. And there are three *new* coatings in the Bitumastic line that have unique properties which you may find of interest: use the coupon below for more information. Or call any Koppers Tar Products Division District Office: Boston, Chicago, Los Angeles, New York, Pittsburgh and Woodward, Alabama. In Canada, Koppers Products, Ltd., Toronto.

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f.o.b. factory: from $30 for 4½-in. to $75 for 8½-in. dial. Source: **Weksler Instruments Corp., 195 East Merrick Road, Freeport, Long Island, N. Y.**

●

Cathodic-protection

. . . rectifiers recently put into production come in four case sizes and have an 11-gage steel case to make them small-arms proof. The four case sizes are designed to cover voltage and current requirements for virtually every application, the maker says. The cases are designed to provide unusual accessibility for maintenance

and servicing. Delivery: 60-90 days. Approximate price, f.o.b. factory: from $140 for the smallest to $750 for the largest size. Source: **Eicor, 4059 West North Avenue, Chicago 39.**

New apparatus

. . . developed, a centrifuge kerosine equivalent type, for measuring the surface capacity, including absorption, of both coarse and fine aggregates used in bituminous mixtures. It can also be used to determine an index of the relative particle roughness or degree of porosity.

A protecting dome and cover of glass fiber surrounds the operating

parts of the centrifuge. The dome mounts on an aluminum circular base that encloses the motor and serves as a switch housing. Delivery: immediate. Approximate net price, f.o.b. factory: $265. Source: **Soiltest, Inc., 4711 West North Avenue, Chicago 39.**

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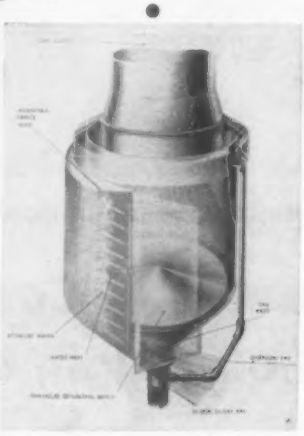

Dust, fume scrubber

. . . recently introduced comes in a wide range of capacities. Compared to other types of high-energy collectors, the Oriclone scrubber, the maker claims, requires 50% less space, has a higher operating efficiency at lower horsepower, and has an adjustable orifice for maintaining peak efficiency when operating conditions vary.

The scrubber has an adjustable rectangular orifice which is said to be advantageous in processes where operating conditions vary. According to the maker, efficiencies in excess of 99% can generally be obtained through the use of the adjustable orifice for capacities ranging from 50% below to 20% above rated capacity. Available capacities range from 10,000 to 40,000 c.f.m. Delivery: 4-6 weeks. Source: **Ducon Co., Mineola, N. Y.**

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Complete self contained units designed to make a hard job easier. Built for every type of stationary equipment. Handle 5,000 lb. thrusts with no external Bearing supports. Specified by more and more oil men for the right way to get more power per ounce of fuel. Write for complete details . . .

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WHEN YOU PAIR-UP MID-CONTINENT TRAVELING BLOCKS..... AND ROTARY TABLES.

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Mid-Continent Traveling Blocks are built with an exceptionally low center of gravity for block action with plumb-line straightness, loaded or unloaded. Sheaves are fabricated from forged steel plate and turn on double-row tapered roller bearings for perfect balance at high speeds. Short, compact and streamlined, Mid-Continent blocks use less space in the mast and give extra room between pipe rack and crown. Mid-Continent Traveling Blocks are available in eleven models from 65 to 300 ton capacity.

MUD-PROOF, ELECTRONICALLY BALANCED TABLES

Mid-Continent Rotary Tables will handle your heaviest strings smoothly and quietly. They're electronically balanced at the factory to relieve vibration stresses on bearings and gear, and triple-sealed to seal drilling muds out and lubrication in. They lock and lubricate from the table top and are square-built so that flooring fits tight on all sides. Mid-Continent Rotary Tables are offered in three sizes and four models to match every drilling requirement.

Team up for more efficiency and a better job with Mid-Continent blocks and tables.

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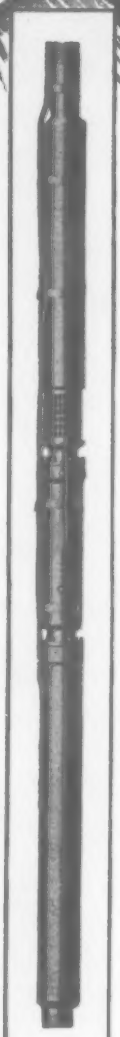

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- **Corrosion-resistant construction**
- **Long life — dependable service**
- **A complete line to meet pumping requirements**

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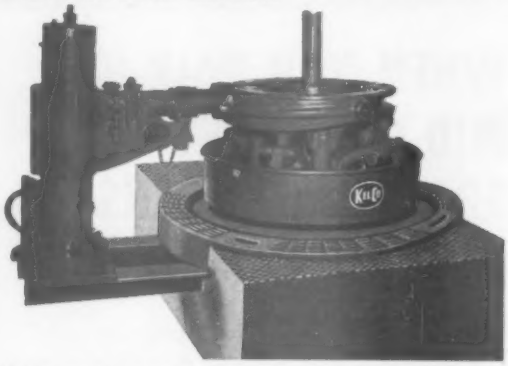
AIR OPERATED POWER SLIPS

KelCo was the designer of the industry's first successful power slips. They are the only slips having incorporated into the assembly a slip bowl. KelCo Power Slips have been in successful service since 1941.



KelCo Model J-6 Slips will handle from 2⅞" drill pipe thru 7" casing. ONLY 5" TRAVEL TO RAISE AND LOWER SLIPS.

KelCo Model J-6-J "Slim Hole" Slips for small rotaries. Will handle 2⅜" thru 3½" drill pipe or tubing, plus 4½" and 5" casing.

KelCo Power Casing Slips. Foot controlled by driller. Protects casing. Gives faster, safer operation. For 4½" thru 7" casing.

NOTE THESE FEATURES OF KelCo POWER SLIPS

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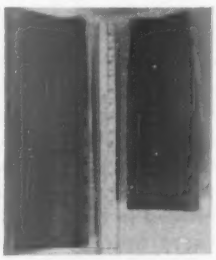
- **Straight in and out movement of dies.**
- **Solid Slip Bowl.**

KelCo Standard Dies-more contact area than any other slips. Have been used successfully to 22,000' without pipe damage. Appx. 156 sq. in. of contact on 4½" dies.

KelCo "Long Dies"—the only answer to problems encountered with drill pipe when drilling below 20,000'. Appx. 186 sq. in. of contact on 4½" dies.



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CATHEADS • POWER SLIPS • TUBING TONGS

In-plant telemetering

. . . is offered by a line of new Chronoflo recorder-receivers. Features include: (1) power positioner with fast yet quiet response, (2) 2, 4, 8, 15, and 60-second time cycles, (3) up to 16 control switches for alarm and control functions, (4) swing-out panel for easy access, (5) modular construction, and (6) multiple pen arrangements.

For telemetering flow, pressure, temperature, level, position, speed, or electrical quantities, the instrument is compatible with supervisory-control systems such as the makers Synchro-Scan, using tone, microwave, or radiotransmission links. Source: **B-I-F Industries, Inc., 345 Harris Avenue, Providence, R. I.**

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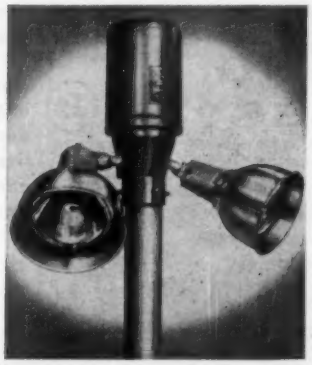


Mercury-vapor

. . . floodlight features a full-floating socket construction that adjusts automatically to variations in lamp sizes and shapes to insure a perfect weather seal with all makes of R-60 reflector lamps—mercury vapor in the 400-watt size and 750-1,000-watt incandescent, according to the maker.

The maker claims that by mounting the socket on a heavy-duty compression spring that literally cradles it in a protective coil of floating steel, many common causes of premature lamp failure are practically eliminated, such as excessive vibration, shock, pole whip, arcing, socket corrosion, and water seepage. The result is a completely weatherproof floodlight. The floodlight is available with lamps, transformers, and several devices for pole-top, surface, or wall-mounting, singly or in clusters. Delivery: immediate. Approximate list price, f.o.b. factory: $12.50. Source. **Stonco Electric Products Co., 333 Monroe Avenue, Kenilworth, N. J.**

•

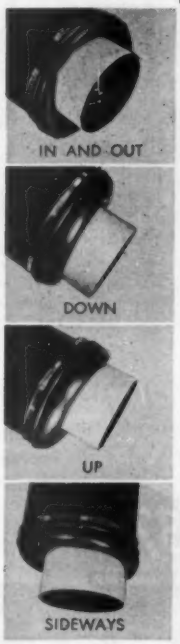
Insulating support

. . . for tank anodes now on the market provides a neat insulating support that seals without bolts by using the anode weight on a vertical pull. The support can be raised for quick anode inspection, and it can be drilled to bring out a lead wire if desired.

The support is designed for easy installation and will support over 500 lb., according to the maker. Source: **Tejas Plastics Materials Supply Co., Box 11302, Fort Worth.**

NEW Casing Seal!
WmSON "U" SEAL

MAINTAINS TIGHT SEAL
EVEN WHEN DRAG SECTION
CHANGES POSITION IN CASING



This versatile and flexible "U"-Seal offers NEW ECONOMY in casing seals.

The special demonstrator pictured shows the flexibility of the "U"-Seal. The pipe position changes, but the seal remains tight. A special fungus and bacteria retardent is added to the compound for extra protection. Seals available in sizes 2" and larger.

VERSATILITY OF INSTALLATION

The fully reversible "U"-Seal is easy to install in the new "U" shape or in WmSon's familiar "Z" shape. A screwdriver is the only tool needed to tighten the two stainless steel bands. Send for technical bulletin.

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Keeps rigs clean, dry, safe! For swabbing or wire line work, replace hazardous manual oil savers with this Field-Proven, Hydraulic Wire Line Stripper.

DOUBLE-E

STRIPS
WIRE LINE DRY
BY REMOTE CONTROL

Sold Through Supply Stores
Write for Catalog and Prices
EQUIPMENT ENGINEERS, INC.
2039 Amelia St., Dallas 35, Texas
LAkeside 6-3873
leaders for 30 years in well completion & pumping equipment

When Buying Blowout Preventers

Why take *less* than

SHAFFER'S SPACE-SAVING COMPACTNESS?

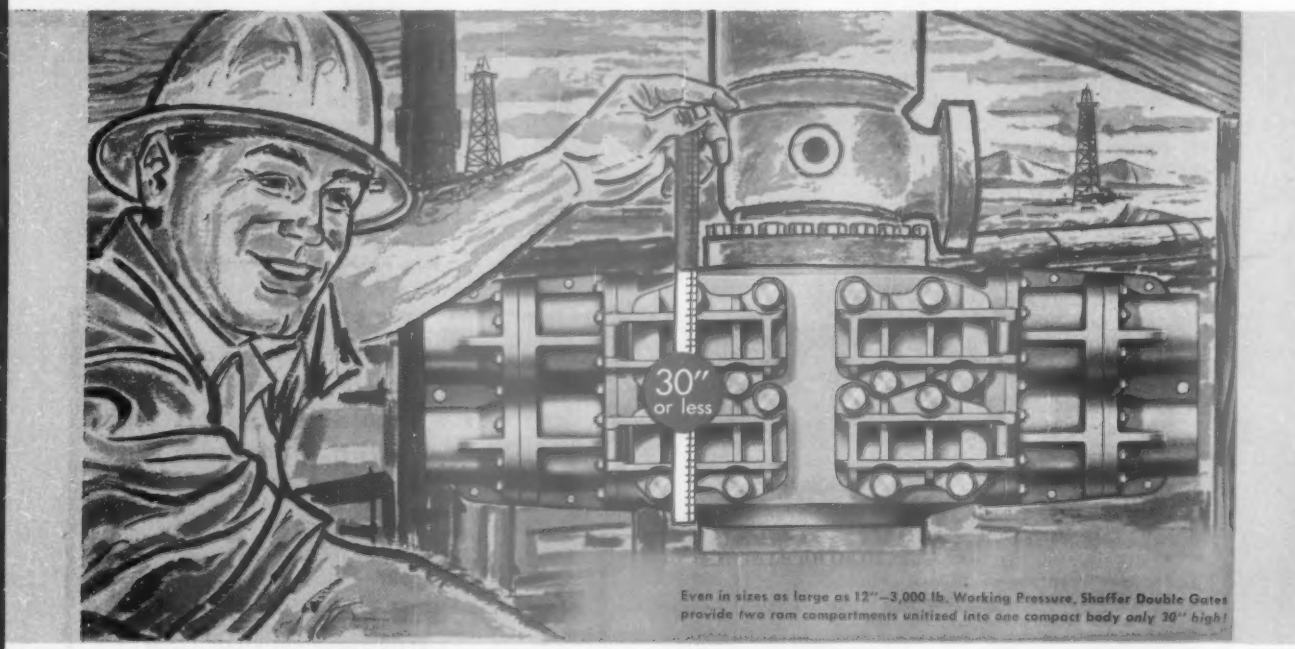
Whether you use cellars—or elevate your rigs—or use a combination of the two—every extra foot of under-rig space wastes money in increased rig-up costs and reduced operating efficiency. That's why it's doubly important to note the multiple ways Shaffer Blowout Preventers save space in your pressure control hook-ups...

1. ***Every Shaffer Gate uses flat rams that combine maximum sealing efficiency with minimum vertical height. Therefore, size for size, Shaffer Preventers are unsurpassed in their space-saving compactness!***

2. ***Shaffer "swing-open" doors for making ram changes further conserve vertical height by eliminating need for extra clearance above each preventer in order to change rams—extra clearance that is necessary where "top-access" ram design is used.***

3. ***Most Shaffer Preventers are available, not only in Single Gate designs, but also in Double Gate designs—two separate ram compartments unitized into one compact, space-saving body that eliminates need for spools and extra connecting flanges.***

RESULT: You make important *multiple* savings in vertical height requirements when you specify Shaffer Blowout Preventers!



Even in sizes as large as 12"—3,000 lb. Working Pressure, Shaffer Double Gates provide two ram compartments unitized into one compact body only 30" high!

SPACE-SAVING COMPACTNESS is just one of many important advantages engineered into ALL FOUR types of Shaffer Blowout Preventers...

TYPE B for general drilling where the compactness of *non-rising* locking shafts is preferred!

TYPE E for general drilling where the quick ram indication of *rising* locking shafts is preferred!

TYPE XHP for extra-high-pressure drilling—to 15,000 PSI *Working* Pressure in 7-1/16" Bore Size... to 10,000 PSI *Working* Pressure in 9" and 11" Bore Sizes!

TYPE LWS for portable blowout prevention on quick in-and-out production jobs (weighs only 780 lbs. in 7-1/16" Bore Size)!

Why not get ALL the facts on the multiple advantages built into Shaffer Blowout Preventers? Write direct for helpful data—or see your nearest Shaffer representative!

37 years OF OIL TOOL LEADERSHIP

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT · FISHING TOOLS THAT EXCEL

CALIFORNIA SERVICE SHOPS: Santa Fe Springs, Santa Maria, Ventura, Avenal, Bakersfield and Taft
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Shaffer Tool Works, Post Office Box 1788
FARMINGTON, NEW MEXICO, Shaffer Tool Works, Post Office Box 546
CASPER, WYOMING, Shaffer Tool Works, Post Office Box 827
HOUMA, LOUISIANA, Shaffer Tool Works, 500 Fifth Avenue, New York, N.Y., U.S.A.
EXPORT SALES OFFICE: Shaffer Tool Works, Inc., 5823 103A Street, Edmonton, Alberta, IN CANADA: Shaffer Western Hemisphere, Inc.

SHOWCASE . . .

New Equipment

In-Line valve

. . . available with a flow coefficient of 7.5, compared to conventional valves with a coefficient of 4.0. The valve is rated for 300-psi. maximum pressure at 180° F.

Called an In-Line valve, it is only 2¾ in. in diameter and 3½ in. long, including hexagonal screwed connections. The plug can be easily reversed in the field without extra parts, according to the maker.

Ported on both sides of the operating piston, the valve can be assembled for spring-to-open or spring-to-close operation. It can be operated without the spring as a double-acting piston for hydraulic actuation. Available in any barstock material, the valve has a bronze sleeve and bridge, stainless-steel plug, and neoprene O-rings. Delivery: 6 weeks. Approximate net price, f.o.b. factory, $120. Source: **George W. Dahl Co., Inc., 86 Tupelo Street, Bristol, R. I.**

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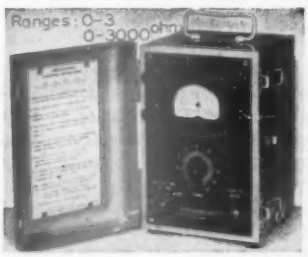


Resistance

. . . of electrical grounds can be measured with a series of portable instruments now being marketed. They are expected to prove useful for measuring the resistance of electrical grounds in electronic, telephone, and electronic power circuits. Three models of the Vibroground series are available. All provide direct reading of ohms resistance to an earth ground. They are self-contained and have battery-operated vibrator power supplies.

The instruments direct-reading ranges of 0-3 to 0-3,000 ohms provide a variety of resistance measurements. Delivery: immediate for some models; 3-6 weeks for others. Approximate net price, f.o.b. factory: from $120 for Model 251 to $575 for Model 275M. Source: **Associated Research, Inc., 3777 West Belmont Avenue, Chicago 18.**

●

Convenient storage

. . . for tools and parts is offered by this unit that lets you arrange an orderly storage system for related tools and parts according to the variation in size between them. Shelves vary in depth from 16½ to 7 in. so each part can be kept at the front, easily seen and reached. The bin dividers are also adjustable horizontally on 1-in. centers.

Over-all cabinet size is 33⅝ in. wide by 17 in. deep by 34½ in. high so it can be inserted into standard steel shelving. Delivery: 1 week. Approximate net price, f.o.b. factory: $53.58. Source: **Bay Products, 1801 West Cambria, Philadelphia 32.**

●

Electronic computer

. . . now on the market is desk size, and offers broad use in engineering and scientific calculations, statistical and business-data processing, data conversion, data logging and acquisition, and industrial control. The Model 160 computer is all-transistorized, can execute 60,000 instructions per second, and handles data transmissions to and from input-output equipment at speeds up to 65,000 characters per second. It is a single-address computer with high-speed parallel mode of operation. Source: **Control Data Corp., 501 Park Avenue, Minneapolis 15.**

For Constant, Uninterrupted
POWER FLOW in the OIL FIELDS
You'll Never Go Wrong with FIELDMASTER BALL BEARING MOTORS

Here's Why . . .

They are specifically designed to overcome the unusual conditions of Oil Field requirements, and there is a type and H.P. built to fit your exact needs. Unexcelled since they are . . .

- DRIP PROOF
- VERMIN PROOF
- MOISTURE PROOF
- CORROSION RESISTANT
- FORCED AIR COOLED
- HAVE SEALED TERMINAL PORT

SEMI-ENCLOSED — normal or medium slip, 3 phase, 60 cycle. Has prelubricated ball bearings in semi-enclosed protected housing, 40 degree C rise. Built for continuous duty. High Torque, low starting current. Extra insulating coating throughout.

TOTALLY ENCLOSED — Fan cooled, normal or medium slip, 3 phase, 60 cycle. Has prelubricated ball bearings, totally enclosed FAN cooled 55 degrees C rise, for continuous duty. High Torque — low starting current. Extra insulating coating throughout.

Write for fully descriptive literature

BETHLEHEM STEEL CO. Supply Division **Tulsa, Oklahoma**

Manufactured by Valley Electric Corporation, St. Louis 8, Mo.

Hi-eF Purifiers remove virtually 100% of the liquid present in hydrocarbon gases without ever requiring maintenance. A patented two-stage design principle of separation eliminates conventional requirements for filters or screens. Lack of moving parts coupled with self-cleaning action assures years of trouble-free service in protecting your gas processes. SPECIFICATION MANUAL 601 contains complete data. Write.

THE V. D. ANDERSON CO. 1977 West 96th Street, Cleveland 2, Ohio

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION

SHOWCASE . . .

New Literature

Residential

. . . oil-burning publication lists some 300 abstracts of technical literature available on this broad field. Prepared for the API by combustion technologists under the direction of specialists at Battelle Memorial Institute, the 110-page publication classifies 16 subjects ranging from fundamental aspects (physics and chemistry of fuel-oil combustion) to the latest equipment developments in the art of oil burning. Source: **Division of Marketing, API, 1271 Avenue of the Americas, New York 20.**

Power-transmission

. . . belting Catalog B-60 presents special advantages and applications of various types of modern belting. One section analyzes and describes Super-Wedge V-belts, designed to reduce the size, weight, and cost of a drive with no loss in horsepower. Source: **Maurey Mfg. Corp., 2907 South Wabash Avenue, Chicago 16.**

Unusual valve uses

. . . are discussed in the first volume of a new house organ — Walworth Today. The three-issue volume, which can be obtained now, features articles written by the Walworth research and engineering department. The publication takes advantage of the presence of valves in industry to spotlight such diverse business worlds as gas transmission. Source: **Walworth Co., 750 Third Avenue, New York 17.**

Pipe-supports book

. . . explains how a new system uses preengineered standard components in almost infinite combinations to solve over 95% of all piping and equipment support problems. Catalog 59 also gives details on constant-support hangers including a new space-saving disk-spring support. Source: **Bergen Pipe-support Corp., 50 Church Street, New York.**

Fire-control chart

. . . which explains the three classes of fires and the approved portable extinguishers to be used on each has just been announced. Free for the asking, the 8½ by 11-in. chart (AD3003R8) shows new extinguishers and gives detailed information on ratings based on

ACCO
for Better
Values

R-P&C VALVES

DESIGNED FOR DEPENDABILITY

BAR STOCK VALVES FOR CLOSE CONTROL, ESPECIALLY SUITED FOR CLOSE-COUPLED INSTALLATIONS

• rated for pressures up to 10,000 PSI •

• The bar stock valve, designed originally by R-P&C engineers, is really a versatile performer. First developed for instrument use, bar stock valves have proven to be the answer to valve problems of many different kinds. Designed for close control, they are ideal for throttling service. Their compactness makes them the natural choice for crowded locations such as panel boards. Economically priced, they serve in many applications as general purpose valves. And they are built in a wide variety of materials—can withstand extremely high temperatures and pressures.

For example, the **Fig. 1040-A Valve** shown here, made from carbon steel, is rated for 10,000 psi at 150°F. Each of these valves is individually tested at 15,000 psi before it leaves the factory.

R-P&C's complete line of bar stock valves includes constructions in 12-14 chromium stainless steel, 18-8 molybdenum stainless steel and bronze. Sizes range from ⅛" to 1" in globe and angle styles with female ends, male and female ends, or male union ends. For extremely severe throttling services, R-P&C bar stocks can be supplied with stellite discs for extra abrasion resistance.

Your R-P&C distributor carries not only a complete line of bar stock valves but also a wide selection of gate, globe, angle and check valves in bronze, iron, and cast and forged steel. You will find the answer to your valve problem in his selection.

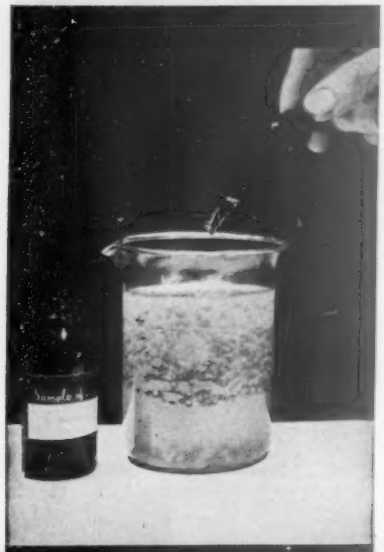
FREE WALL CHART
"How to Protect Your Valves"
Installation pointers, operating tips, clues to longer valve life. They are all on this 22" x 17" wall chart. Write for your free copy.

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

ACCO

MUD REMOVAL?



MUDBAN

Mudban* is a Dowell product used to help remove mud cake and excess drilling mud from wells; and to help remove mud lost to producing formations. It is added to the oil used in well clean-out work. Mudban is effective on almost all types of muds. It is a non-acid mud dispersing agent. Mudban is low-cost too. Be ready. Keep a can of Mudban on hand. Available in 10-gallon steel drums from all Dowell stations.

*Dowell Trademark

Products for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

DIAL DOWELL

the latest U.L. standards. Source: **Walter Kidde & Co., Inc., 675 Main Street, Belleville 9, N. J.**

Free lubricant sample

. . . of Molykote G is now being offered. A grease-consistency lubricant, it reportedly eliminates fretting, galling, seizing, and metal pickup in high-bearing-pressure applications. The sample will be accompanied by four-page Bulletin 126B which describes possible application instructions. Source: **Alpha-Molykote Corp., 65 Harvard Avenue, Stamford, Conn.**

Gas regulators

. . . booklet contains information about four pilot loaded models which can be used for any type of regulation requiring accurate outlet pressure conditions with normal capacities greater than 5,000 cu. ft. per hour. The new information piece also includes data on pilot controls for the regulators. Source: **Reynolds Gas Regulator Co., Inc., P.O. Box 1, Shreveport, La.**

Ballast-tray

. . . Bulletin 160 gives performance curves and detailed data on the new V-1 fractionating device, based on laboratory tests recently conducted. According to the bulletin, the ballast tray is a valve type that uses two-stage vapor discharge units with single moving elements. These units position themselves initially on the tray for low to medium vapor rates and then are free to travel vertically to provide an increased orifice for very high vapor rates. Source: **Fritz W. Glitsch & Sons, Inc., P. O. Box 6227, Dallas.**

All-weather tank vent

. . . that is preengineered to keep gasoline, solvent, and chemical tanks under low pressure or vacuum at all times, is discussed in four-page Bulletin 6029. It illustrates a Dry-Air venting system which incorporates in the vent line a dryer using lump anhydrous calcium chloride as a dessicant to remove moisture from atmosphere entering the tanks during relief of vacuum caused by product withdrawal or thermal contraction. Source: **Midland Specialties Co., 4801 South on Richmond Street, Chicago 32.**

Heat-exchangers

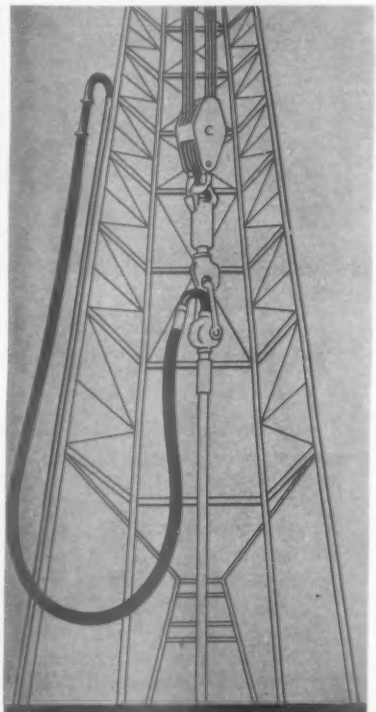
. . . manual presents the Polybloc impervious graphite heat exchanger. Featuring full-page illustrations, cutaways, diagrams, and design data, the 20-

REPUBLIC ROTARY HOSE

mud engineers agree . . . .

"NO KNOTS IN REPUBLIC HOSE!"

Equal tension on each steel cable prevents knots.



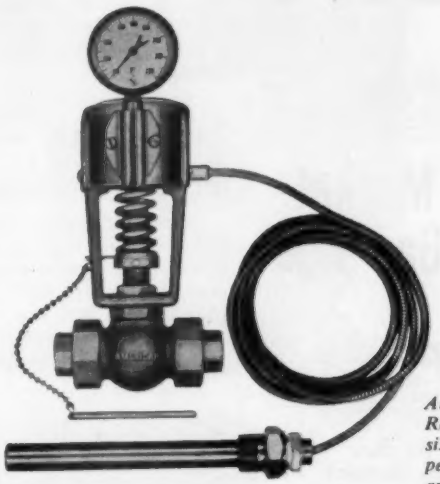
REPUBLIC RUBBER

DIVISION, LEE RUBBER & TIRE CORP.
YOUNGSTOWN 1, OHIO

For information on Rotary, Mud Pump Suction or Vibrator Hose, write to: Republic at Youngstown or check your local J & L Supply Store.

immediate

AMERICAN TEMPERATURE REGULATORS begin corrective action with less than 1/10 degree change at the bulb



American Temperature Regulators are made in sizes ½" to 4". Temperature ranges as low as minus 15° F. to 50° F.—as high as 240° F. to 350° F.

response

You get fastest possible temperature response from these new regulators because the stem cannot bind and retard valve action.

The valve stem on American Temperature Regulators is sealed off by a friction-free bellows that makes practical a nonleaking packless valve. Also contributing to fast, stable action is the use of an extra-long preflexed adjusting spring. This spring permits a long range of temperature adjustment without disturbing valve sensitivity at normal levels.

There are other high-quality features in American Temperature Regulators: maximum use of stainless steel; standardized parts; the fewest possible components; and unitized assembly. In addition, compactness simplifies installation in "tight" locations.

Accurate temperature regulation and attention-free operation mean long-term economy. Your industrial supply distributor will gladly help you select the right American Temperature Regulators for your needs. Write for Bulletin 114A.

MANNING MAXWELL & MOORE INC. M M TRADE MARK

AMERICAN TEMPERATURE REGULATORS

A product of

MANNING, MAXWELL & MOORE, INC.

Gauge and Instrument Division • Stratford, Connecticut
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

INTER-URBIA

Growth Market for the Gas Age

Concentrated in the New York-Newark Interurban complex are more natural gas consumers than in any single *state* of the union. Not satisfied to remain America's Number One Market for consumer goods and services, Interurbia expects to grow another 10% this year.

Such a unique combination of growth and stability means unequaled security for gas producers supplying this modern City State of the Gas Age.. Via Transco, producers in Texas and Louisiana can tap the market where the most people are.

TRANSCONTINENTAL GAS PIPE LINE CORPORATION

page literature also contains charts, graphs, typical calculations, examples, and specifications. Source: **Carbone Corp., Boonton, N. J.**

Vital fields

. . . of laboratory interest — chromatography, spectrophotometry, and pH—are highlighted in new Catalog C-60 with complete descriptions of over 500 items. Many types of instruments and supplies for gas chromatography are included. Featured in the 28-page publication are gas chromatographs with all components, attachments, and accessories. Source: **Schaar & Co., 7300 West Montrose Avenue, Chicago 34.**

Tiny vertical indicating gages

. . . with 5-in. scales for measuring and indicating draft, pressure, differential pressure, temperature, and pneumatic signals, are outlined in new 12-page Bulletin 59-1 just issued. Source: **Republic Flow Meters Co., 2240 Diversey Parkway, Chicago 47.**

Breaking-strain

. . . tables and general wire-rope data are contained in a new 127-page catalog, published specially for areas that use ASA tables. This catalog—available upon request—follows closely on a similar one published recently for the Canadian market. Source: **Martin, Black & Co. (Wire Ropes), Ltd., Speedwell Works, Coatbridge, Scotland.**

Safety cable

. . . catalog has been revised and a new section added covering hazardous-area uses which have been approved by Underwriters' Laboratories. Another section covers mineral insulation for instrumentation purposes. The 20-page catalog is filled with general information on the wiring system itself. Source: **General Cable Corp., 730 Third Avenue, New York 17.**

Trenching machine

. . . has five digging widths—2¾, 3½, 4, 6, and 8 in., up to 54-in. deep, as detailed in a new folder. It reports that digging speed of the Model MA-2 Trench Devil is variable from 0 to 1,200 ft. per hour in either direction. The six-page literature is packed with pictures, features, job applications, and specifications. Source: **Arps Corp., New Holstein, Wis.**

Multiport relief-valve

. . . bulletin describes and illustrates a series of valves for automatic safe relief of overpressure in steam, air, and gas systems up to 250 psig. Bulletin 5200-A offers photographs and drawings to show the valve's operating principle, basic types available, application in systems, and typical installations. Charts and tables list basic sizing data, sizing instructions, and style and construction details. Included is a sample specification form. Source: **Cochrane Corp., Seventeenth Street Below Allegheny Avenue, Philadelphia 32.**

Coal-tar

. . . protective coatings are illustrated in new Brochure CAC-11-598, yours for the asking. Primarily moisture barriers and impervious corrosion proofers, the coatings reportedly are particularly suitable for application on buried or immersed steel and concrete structures. The 16-page brochure lists detailed specifications, resistance properties, and typical uses. Source: **Plastics & Coal Chemicals Div., Allied Chemical Corp., P. O. Box 75-W, New York 6.**

Hardness conversion

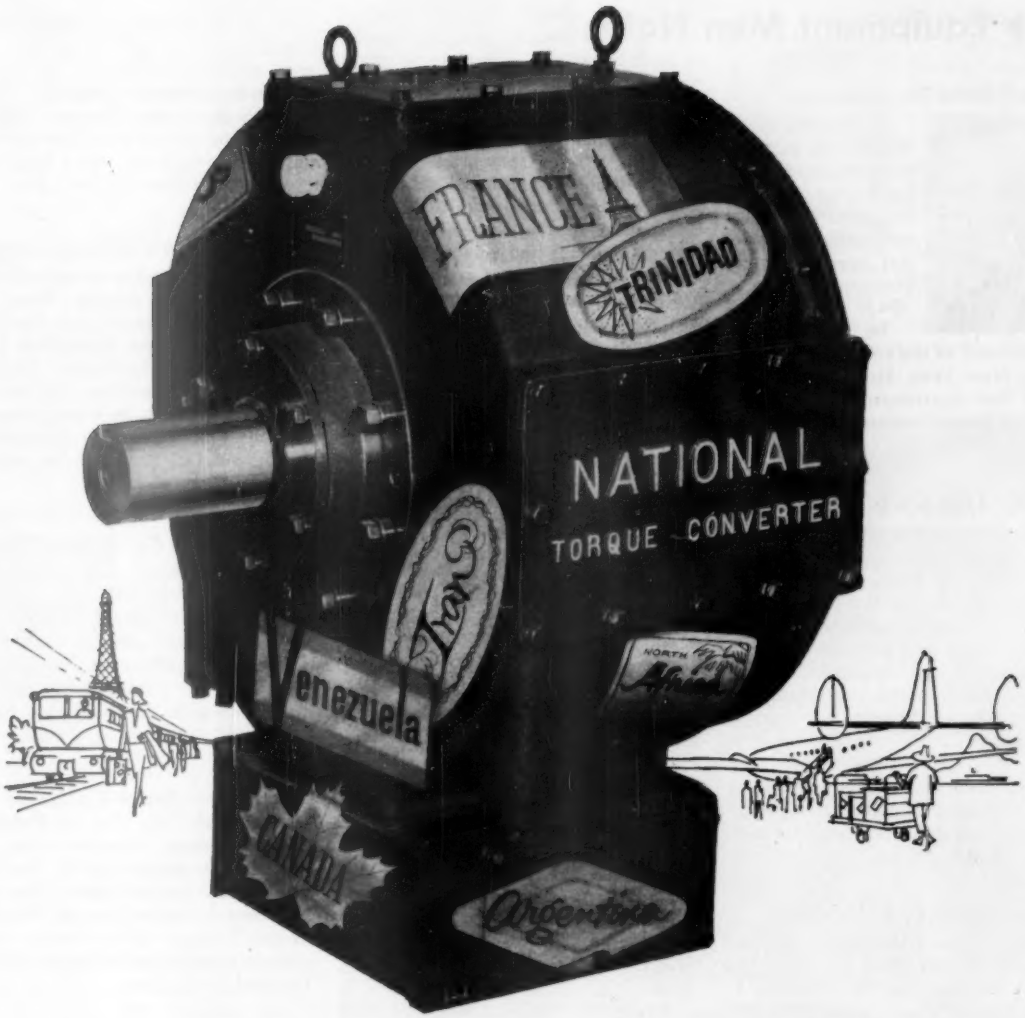
. . . chart shows the approximate relation between hardness by various testing systems and tensile strength of carbon and alloy steels. The hardness systems covered are Brinell, Monotron, Vickers, Rockwell (B, C, and E scales), and Scleroscope. Source: **Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa.**

Scale and corrosion

. . . control solutions offered in a newly revised bulletin just issued. The literature is in the form of a telescoped sheet of 11 different drums—each a Glucosate—directed to some special use in correcting and controlling scale and corrosion factors. Source: **D. W. Haering & Co., Inc., P. O. Box 10337, San Antonio 21.**

Thermocouple

. . . components called QuiK-Konnect easily and quickly connect thermocouples to extension wire, as described in new Specification FS005-3. According to the four-page literature piece, the components assure foolproof connection in a short amount of time, making them practical wherever periodic connection or disconnection of thermocouples is required. Source: **Industrial Div., Minneapolis-Honeywell Regulator Co., Fall River, Mass.**



National Torque Converters are "Globe-Trotters"

If National Torque Converters carried travel stickers—as the luggage of tourists does—you'd see at a glance what globe-trotters these products really are.

We know of rigs equipped with Torque Converters that are drilling or have recently drilled in the Argentine; in Canada; in Venezuela; in Trinidad; in France; in North Africa; in Iran. They are helping to transmit power smoothly, not only on domestic prime movers, but on MGO, Fiat and Paxman Engines, which further expands their global field of operation.

This widespread use in remote corners of the earth points up a very important feature of National Torque Converters. Overseas drilling locations are a long, long way from parts depots and repair shops, and breakdowns must be avoided at all costs. The reliability that is built into every National Torque Converter is a major advantage. These Converters not only help a rig to make more holes faster with less strain on operator, and do more useful work, but they add materially to the life of the rig and engines.

A Torque Converter Bulletin, No. 469, has recently been issued. If you would like a free copy, please write or call your nearest National Supply representative.

Steel's Symbol of strength, long life, and economy

THE NATIONAL SUPPLY COMPANY

Two Gateway Center, Pittsburgh 22, Pennsylvania

Subsidiary of Armco Steel Corporation

▶▶▶ Equipment Men Notes

Ingersoll-Rand Co. promotes

. . . Joseph A. Wiendl to general sales manager from his former position as assistant general sales manager. He has been with the company since 1941.

In 1948 Wiendl was promoted to the rock drill department in New York. He became manager of that department in 1957 and assistant general sales manager in February 1959.

Pan Geo Atlas Corp. sets up

. . . a new French subsidiary company—PGAC Sahara, S.R.L.—with headquarters in Paris, according to Paul Charrin, president of the Houston corporation. At the same time, Charrin said that the subsidiary's field operations are already under way in the Algerian oil fields performing all types of oil-well logging, perforating, and other wire-line completion services.

M. DeMalleray is general manager of the French subsidiary. Field operations are being directed from Maison Rouge, OCRS, Africa.

Arthur G. McKee & Co. elects

. . . William B. Hudson, Jr. to the post of vice president in charge of refinery engineering. He succeeds F. Drake Parker who is presently acting as managing director of McKee Head Wrightson, Ltd., in London. Before joining McKee, Hudson was with Foster Wheeler Corp. for 19 years in various technical and executive positions.

Meanwhile, Edwin G. Graeber was appointed technical director in charge of process engineering for the company's refinery division. In this capacity he will be responsible for the process design of petroleum refineries, chemical, and petrochemical plants. He replaces Luther R. Hill who resigned. Graeber had previously spent 9 years with McKee as assistant chief process engineer. Most recently he was associated with Air Reduction Co., Inc. as chief process engineer.

Floyd Hentschel is appointed

Floyd Hentschel

. . . district manager of Delta Tank Mfg. Co., Inc.'s Oilfield Equipment Division with Shreveport headquarters. He is a veteran of 24 years in the petroleum-equipment business. Meanwhile, J. Roger Heumann was named process sales engineer for Delta's Houston oil-field-equipment operations office. Heumann, who joined Delta in February, has 12 years experience in petroleum equipment.

Republic Supply Co. transfers

. . . Richard Evans, Jr., to Wichita Falls, Tex., where he will be a sales representative, and appoints H. A. Golden as store manager in Healdton, Okla.

Evans has been with Republic since 1953 after serving as store and field man for Bethlehem Supply for several years. He has been in sales and store-manager posts with Republic at Lindsay, Ardmore, and Healdton, Okla.

Golden formerly was employed by Warren-Bradshaw Drilling Co., Bethlehem Supply, and Murray Tool & Supply. He joined Republic in 1954 and for several years was a field representative in Elmore City, Okla.

Southern Engine & Pump named

. . . distributor for Minneapolis-Moline oil-field engines, reports Roger R. Hipwell, sales manager of the Construction and Power Equipment Division of Minneapolis-Moline. The territory assigned includes the eastern half of Texas with its western boundary on a line between Gainesville, Waco, and Del Rio, and the western half of Louisiana.

Solar Aircraft Co. names

. . . Jack L. Duke as a sales representative for the company's gas-turbine engines and turbomachinery products in Houston and the Gulf Coast area. Duke's offices will be in Houston. Prior to joining Solar, he was district manager for Lynn McGuffey, Inc.

Continental-Emsco Co. buys

. . . Win-Well Mfg. Co., of Tulsa, including patents, inventory, jigs, and fixtures for production of the Win-Well rotary selector valve. The valve will now be known as the Win-Well Green Triangle rotary selector valve, and is being manufactured at C-E's Garland, Tex. plant.

Lincoln D. Hall to manage

. . . the newly created midwest district of Tube Turns Division of Chemetron Corp. Locating in Kansas City, Hall will be in charge of sales in a 10-state territory. The new midwest district manager joined Tube Turns in 1951. He was Tulsa district manager before moving to the division's headquarters in 1955 as assistant sales manager supervising western regional operations.

Robert F. (Pete) Holcomb joins

. . . the sales staff of Crossett Chemical Co., manufacturers of Seeco-Mul drilling-mud additive, according to T. C. Clarkson, general sales manager. Holcomb will make his headquarters at the company's general offices in Crossett, Ark.

NEW CEMENTING UNITS of Dowell Division of The Dow Chemical Co. are shown in action on a Gulf Coast cementing operation. Dry cement and admixtures are fed through air lines from the transport to the paddle-type slurry mixer, positioned at ground level at the rear of the cementing unit. The bulk cement tanks on the transport have capacities of 300 sacks each. The photo also points out the operator's deck-control position.

Dorr-Oliver, Inc. establishes

. . . a new Petroleum and Petrochemical Division within its industrial sales area. Under the direction of Oscar W. Johnson, the division will be responsible for equipment and engineering sales to Dorr-Oliver customers in petroleum exploration and production, pipelines, and refining; in petrochemicals; and in plastics and synthetic-rubber production.

In addition to Johnson, the division comprises Arthur A. Regal, who will operate from the D-O Stamford, Conn. office; V. P. Chwalek, who will cover the north-central region from the Chicago office; W. L. Oliver III, south-central region from a new office in Houston; and R. D. Eddington, western region from offices in Oakland.

William Roever named manager

W. A. Roever

. . . of Clark Bros. Co.'s newly created Dallas district office, announces George W. Probst, vice president of sales. Roever will be responsible for the sale of Clark engines, compressors, and gas turbines in the central part of Texas and the lower half of New Mexico. He has been with the Clark organization since 1946, serving successively as sales engineer, Dallas branch manager, and senior branch manager.

Newitt appointed sales engineer

. . . for the Texas Division of Collins Radio Co. in the New England area. A resident of North Scituate, Mass., John H. Newitt has nearly 20 years of engineering and marketing experience.

He has been active in the Boston area for the past 10 years, including work with Lincoln Laboratories. His appointment was announced by Carl W. Service, director of sales for Collins Texas Division.

French company is organized

Roger Henquet

. . . to provide completion and production services in the Mediterranean oil fields. The new company — called Flopetrol — is headed by Roger Henquet and makes headquarters in Paris. Operations manager is Jean Drivet.

Flopetrol has been incorporated with an original capital of about $250,000 by Compagnie d'Exploration Pétroliére, Société d'Etudes Pétroliéres, Coservices, and Géopétrole. A program of expansion is planned first to North Africa and the Sahara, then to all European and Middle East oil-producing areas.

Operations will include wire-line services, rods pulling, bottom pumps maintenance, paraffin control, installation and repairs of production and transportation control equipment. The company plans to call on American technicians to train its local personnel and to develop the newest production techniques in the Eastern Hemisphere.

W. A. Laukaitis takes over

W. A. Laukaitis

. . . as eastern regional marketing manager for Southwestern Industrial Electronics Co., a division of Dresser Industries, Inc., reports R. O. Vaughan, vice president of marketing. Laukaitis' primary duties will be in technical liaison and sales between SIE and government agencies in the Washing-

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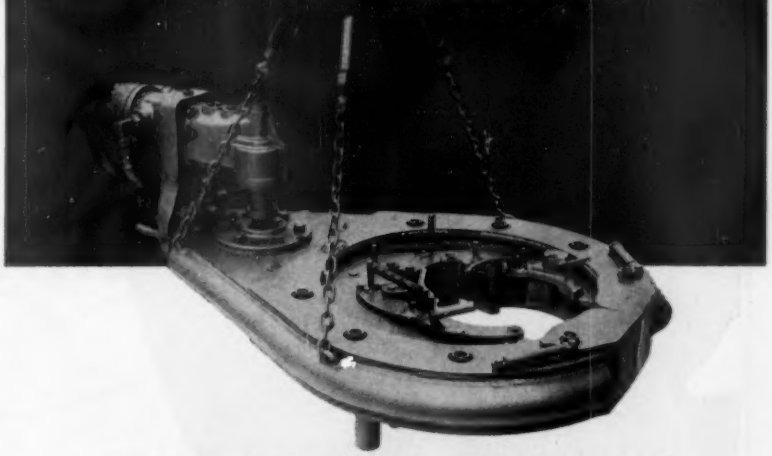

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ton, D. C. area. He was formerly manager of W. L. Maxson Corp.'s Washington office.

Charles Beeghly elected prexy

. . . of Jones & Laughlin Steel Corp., according to Avery C. Adams, chairman of the board of directors.

Beeghly has served as executive vice president since April 1958 and as a corporation director since October 1957. He was president of the J&L Strip Steel Division with headquarters in Youngstown until being elected executive vice president of the corporation. Beeghly is a veteran of more than 25 years in the steel industry.

Parsons Powergas is formed

. . . as a joint enterprise by Ralph M. Parsons Co., engineers-constructors of Los Angeles, and P-G Engineering, Ltd., a member of the Power-Gas Group, an organization of British companies. The new concern, with headquarters in London, will perform engineering and construction of petroleum, petrochemical, and related plants, backed by the combined resources and experience of the parent companies.

Initially, activities will be concentrated in the British Commonwealth. The two firms will each appoint three men to a committee which will direct the enterprise. Parsons has named Vice Presidents Harry Broom and Robert V. Peaslee, and Ahmet Neyzi, European operations manager, to the committee. R. W. Rutherford, managing director of P-G Engineering, so far has been appointed to the committee. Peaslee will serve as general manager of Parsons Powergas.

Byron Jackson Tools promotes

J. P. Kirby

. . . three oil-tool sales employes in the Mid-Continent region, reports R. J. Evans, Jr., vice president and domestic sales manager of the Borg-Warner subsidiary. John P. Kirby has been named product sales manager for BJ tubing swabs. He was formerly district manager of Southeast New Mexico and West Central Texas and city sales representative for the Dallas-Fort Worth area. A 12-year veteran of BJ Tools, Kirby will continue to headquarter in Fort Worth.

F. J. (Jack) Gray moves from Odessa to become city sales representative for the Dallas-Fort Worth area. He has been a BJ sales representative in Odessa since joining the firm in 1955.

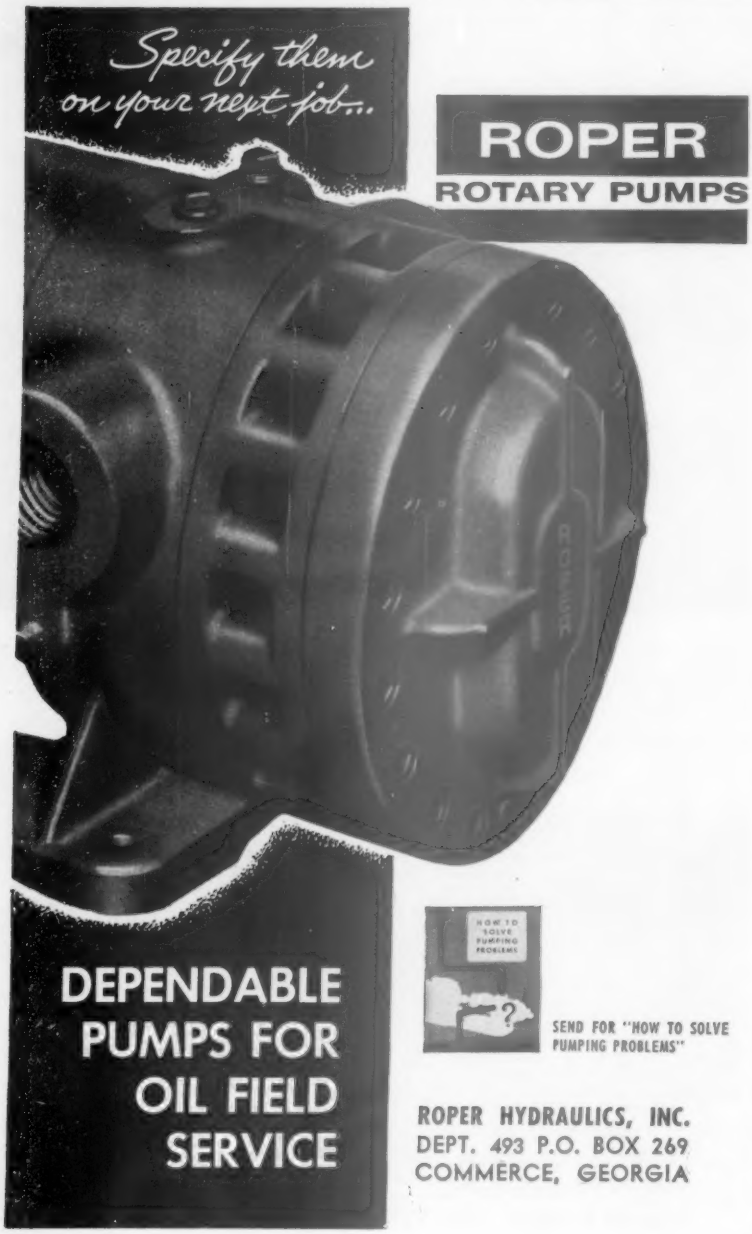
V. J. (Jack) Carter becomes district manager locating in Odessa. A former sales representative in Hobbs, he recently moved to Odessa to act as sales supervisor for the West Texas-New Mexico area. Carter joined Byron Jackson in 1951.

Mason B. Jones, Jr. takes over

. . . as factory sales representative in Dallas for sucker rods of S. M. Jones Co., reports Lockett J. Pundt, general sales manager. The new representative will cover East Texas and a part of West-Central Texas, as well as assist the present representative in Dallas and Fort Worth. He recently completed a year of training at the company's factory in Toledo and sales headquarters in Tulsa.

L. H. Ralston to cover

. . . the Dallas-Fort Worth area and part of Oklahoma for Atlas Pipe, Inc., announces Tom Pearson, general sales manager of Atlas. Ralston's oil-industry experience covers more than 23 years, including activities in sales, purchasing, and oil-field trucking. Ralston, who formerly worked for National Supply Co. and Sohio Petroleum, will operate out of the company's Houston office.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Earl McGill is named assistant

. . . to the director of sales for Skinner Brothers Co., Dallas-Tulsa oil-field-equipment manufacturer, according to W. E. (Bill) Esslinger, director of sales. McGill's promotion follows 5 years of service as a Skinner field representative in the Permian and Delaware basin area, selling and servicing company equipment.

McGill's new responsibilities include developing new contracts for the molding of rubber products and components at the Skinner facility in Dallas. He will also assist Esslinger in duties concerned with the support of company field representatives in all oil-producing areas of the country.

R. C. Crowe becomes manager

. . . of product sales for Wolverine Tube Division of Calumet & Helca, Inc., in which post he will be responsible for the sale of all division products on a national basis.

Since joining Wolverine in 1950, Crowe has served as industrial and public-relations supervisor as well as in various sales capacities, including manager of industrial sales. He replaces L. G. Fox, who will now take up a similar position with Flexonics Corp., a recent acquisition of Calumet & Hecla, Inc., as a subsidiary firm. Crowe will locate at Wolverine's administrative office in Allen Park, Mich.

Dixon becomes branch manager

. . . of the Detroit office of Peerless Pump, Hydrodynamics Division, Food Machinery & Chemical Corp. The announcement comes from Gerald F. Twist, FMC vice president and division manager.

P. M. Dixon

Philip M. Dixon joined Peerless in 1941 as a project engineer at the Quincy, Ill. office. Following release from the Armed Forces in 1946, he returned to Quincy where he continued as project engineer until his transfer to Indianapolis in 1948. Since 1950 he has been on the sales staff in Peerless' St. Louis office.

Lucey Products to distribute

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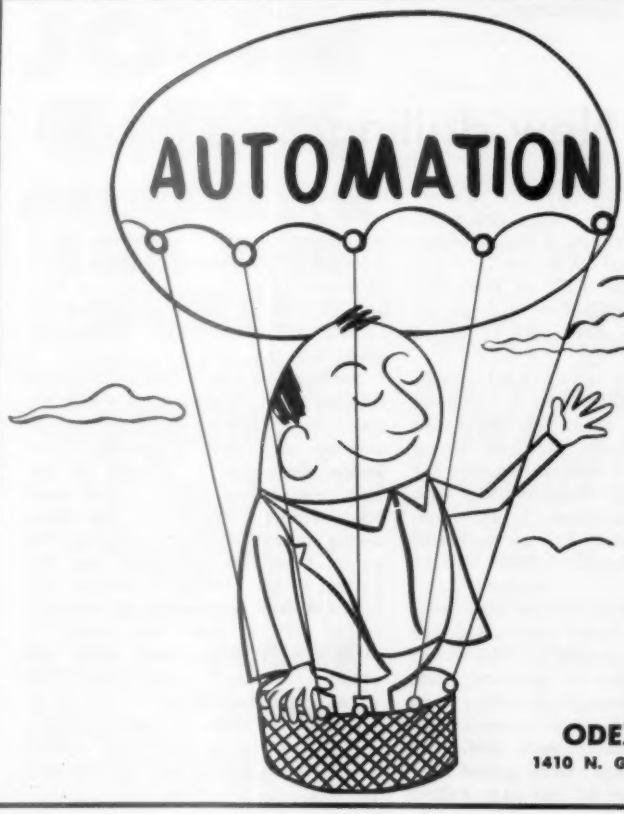

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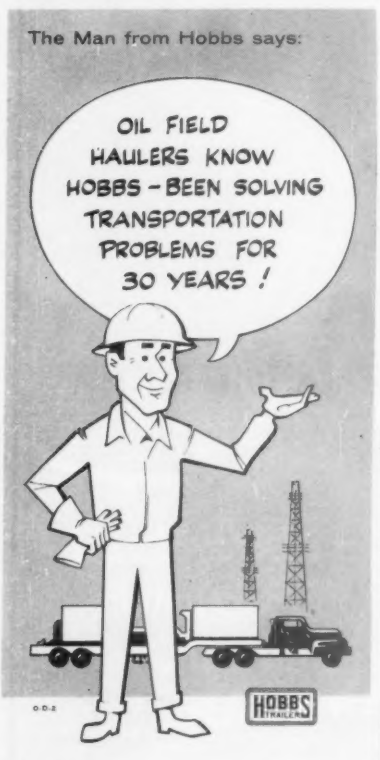

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Among the Drilling Contractors

At this rig off the South Louisiana shore, cooperation between . . .

J. H. (Jim) Wallace

David R. Jones

men like these resulted in a . . .

New drilling-time record

CLOSE COLLABORATION between Rowan Drilling Co., Inc., and Gulf Oil Corp. has resulted in new drilling-time record. Well 79 on the Gulf Oil Corp. State Lease 1772 in Timbalier Bay field was drilled to a depth of 10,000 ft. in 4 days and 17 hours from spud time.

Equipment of advanced design played an important part in reducing over-all drilling time, but the record was set by excellent teamwork. David Jones and Ray Gross, supervisors for Gulf, worked hand-in-glove with Rowan Superintendent J. H. (Jim) Wallace and other Rowan personnel in planning the last detail of the operation.

This is the way the job was done:

A 24-in. conductor pipe was driven to approximately 150 ft. The casing head was welded to conductor pipe and 12-in. blowout preventers were nippled up and tested thereon. Design on the casing head will allow setting two strings of casing and landing two strings of tubing without further disturbing the blowout-preventer assembly. A 15-in. surface hole was drilled with 12¼-in. bit on 15-in. retractable blade underreamer to 3,520 ft. where 10¾-in. surface casing was set. A 9⅞-in. hole was drilled to 12,200 ft. where 4-in. production string was set.

Surface hole was drilled in 15 hours' rotating time (including seven slope tests) using 200-r.p.m. rotary speed and up to 25,000 lb. on bit. Two pumps were run in parallel on the hole, one taking suction from mud pits, pumping 630 g.p.m.; the other taking suction from bay, pumping 290 g.p.m. Total fluid circulated was 920 g.p.m., giving 120 g.p.m. annulus velocity, 395 ft. per second jet velocity.

The 9⅞-in. hole was drilled to 10,000 ft. in 57 rotating hours (including 14 slope tests), using 180-r.p.m. rotary speed, up to 40,000 lb. on bit. One pump was used, circulating 540 g.p.m. at 2,500-psi. surface pressure through three ⅜-in. bit nozzle jets.

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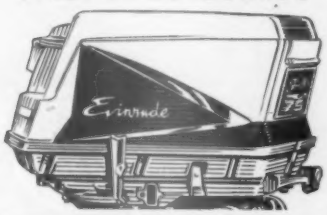

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This time surpasses the record set by Gulf and Kerr-McGee Oil Industries, Inc., (OGJ, Jan. 11, 1960, p. 44) with the latter's Rig 46 which drilled 10,000 ft. of hole in 4 days, 21 hours, and 48 minutes, also in the Timbalier Bay area in Block 21.

Drilling Log

March 22, 1960

Moved onto location, nippled up 12-in. blowout preventers on special head welded to 24-in. drive-pipe conductor, test blowout preventers, pick up Servco 15-in. underreamer with 12¼-in. bit, nine 7½-in. drill collars, spud 12 midnight.

March 23

0000-1500 Drilling and underreaming 15-in. hole to 3,520 ft. Took seven slope tests.

1500-2100 Wiping trip, conditioning mud, and trip out to run surface casing.

2100-2400 Rigging up and running 10¾-in. casing.

March 24

0000-0400 Finish running and cementing 10¾-in. casing, set at 3,516 ft.

0400-0800 Waiting on cement.

0800-1200 Tested casing, picked up fifteen 6¾-in. drill collars, 9⅞-in. bit, tool in hole.

1200-2400 Drilling to 6,100 ft. and four slope tests.

March 25

0000-0200 Drilling to 6,200 ft. and one slope test.

0200-0600 Round trip, looking for washout and change bits.

0600-2200 Drilling to 7,910 ft. and four slope tests.

2200-2400 Started trip to change bits.

March 26

0000-0300 Finished trip to change bits.

0300-1500 Drilling to 8,709 ft. and two slope tests.

1500-2000 Round trip to change bits and slip drilling line.

2000-2400 Drilling to 9,145 ft.

March 27

0000-0400 Drilling to 9,388 ft. and two slope tests.

0400-1000 Round trip to change bits.

1000-2000 Drilling to 10,165 ft. and one slope test. Reached 10,000 ft. at 1700 (4 days, 17 hours from spud).

2000-2400 Trip to change bits.

It took 72 hours rotating and 21 slope tests to 10,000 ft.

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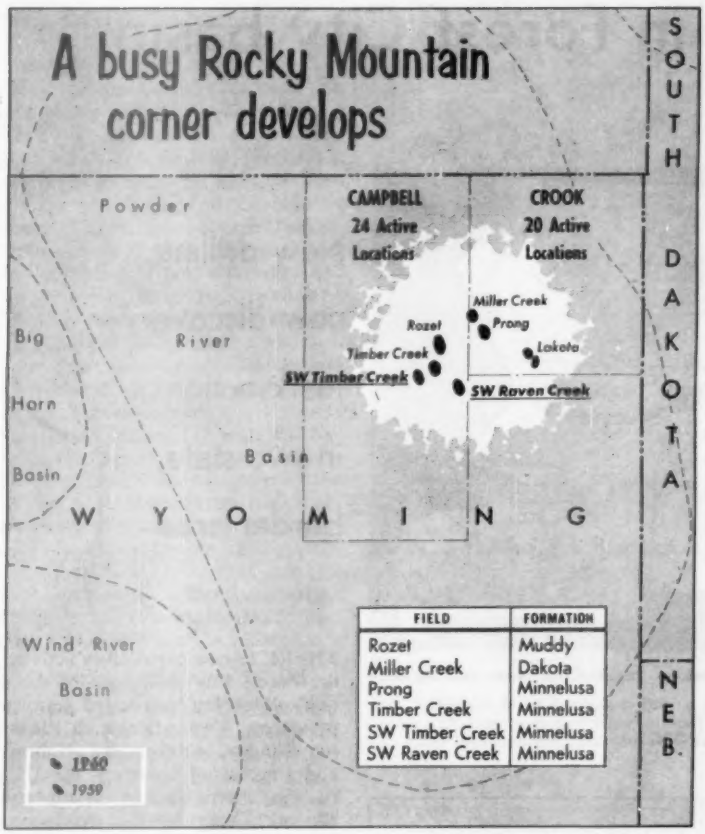


THREE WYOMING PAYS, Dakota, Minnnelusa, and Muddy, are slated to become Powder River exploratory guideposts.

Powder River basin has stars in its eyes

BY JOHN C. McCASLIN

GREEN RIVER BASIN may have to yield its "most active" position to the Powder River basin in northeastern Wyoming this spring. With one of the worst drilling seasons in many years behind it, Powder River is geared for what shapes up to be the biggest exploratory campaign since Clareton trends days.

Two busy counties. Most of the Powder River furor is in the northeastern corner of Wyoming in Crook and Campbell counties. Here 44 active locations are shoving this corner of the Rockies near first place in regional activity.

Last year about 18.5% of Wyoming's total exploration was done in these counties. Discoveries here amounted to 17.5% of the state's 1959 successful wildcats. Four new fields and new pays have been opened in the two counties so far this year.

Three pay objectives. Exploration in the northeastern part of Powder River basin in the past few years has taken three steps . . . to the Dakota, then on down to Pennsylvanian, and recently back up the hole to Muddy above the Dakota.

. . . **Dakota.** Cretaceous Dakota exploration sired several good oil fields. Coyote Creek and Donkey Creek are the two principal finds. Development has been more or less steady in these two areas, and success has been high.

. . . **Pennsylvanian.** Not satisfied with finding good Dakota production, Wyoming explorers dug deeper into Minnelusa rocks. The result was a significant list of new Pennsylvanian fields in an area where no such oil had ever been found before. Pennsylvanian oil was found and developed at Robinson Ranch, Miller Creek, Prong, Timber Creek, and at scattered other smaller discoveries. This year two new Minnelusa fields have already joined the family . . . Southwest Timber Creek and Southwest Raven Creek. The Raven Creek discovery, Kewanee Oil Co. 1 Norman, pumped 440 bbl. per day on completion at 8,338-65 ft. while True Oil Co.'s Southwest Timber Creek discovery pumped 125 bbl. per day.

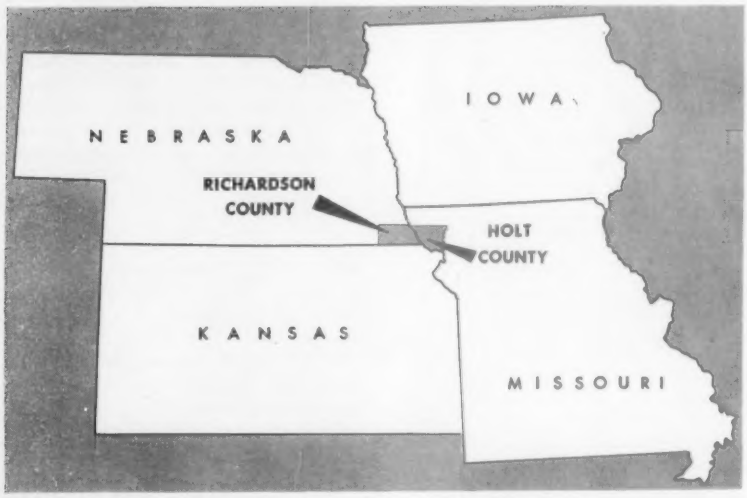
Of the 24 active Campbell County wells, 3 are Pennsylvanian tests, 2 of which have indicated success. There are 7 Pennsylvanian tests going in the 20-well program in Crook County. Crook County is the more attractive Pennsylvanian target of the two counties because of the amount of previous Minnelusa exploration, and the shallower depth of Pennsylvanian rocks.

The Pennsylvanian push in northeastern Wyoming began with deep drilling at Donkey Creek. Then came Robinson Ranch, confirming the fact that Minnelusa rocks are highly productive and available in this section of the basin.

. . . **Muddy.** While looking for Pennsylvanian oil near Rozet, Wyoming oil hunters came upon one of the best Cretaceous fields in the state. There was no oil in the Minnelusa, but going back up the hole they found what has developed into a 23-well Muddy sand field. Rozet is just 1 year old. Its limits are as yet undefined except possibly on the north, west, and south. Large areas on the southwest, southeast, and northeast sides of the field lie undrilled. Sinclair opened the field at 1 Svalina in April 1959 at 6,935 ft.

Push Wyoming drilling. While most of the drilling noise seems to be in Pennsylvanian rocks on the northeast side of the basin, other Powder River areas will soon be heard from. Signal Drilling & Exploration Co. et al., will deepen an old well south and west of the Clareton trend in Converse County to Minnelusa. Closest Minnelusa drilling is 18 miles north. Muddy exploration and development will continue at a fast clip, stirred on by the booming Rozet field. There is still lots to be done in the Dakota section around the northern part of the basin. All these ingredients should help Powder River regain its "Clareton days" flavor.

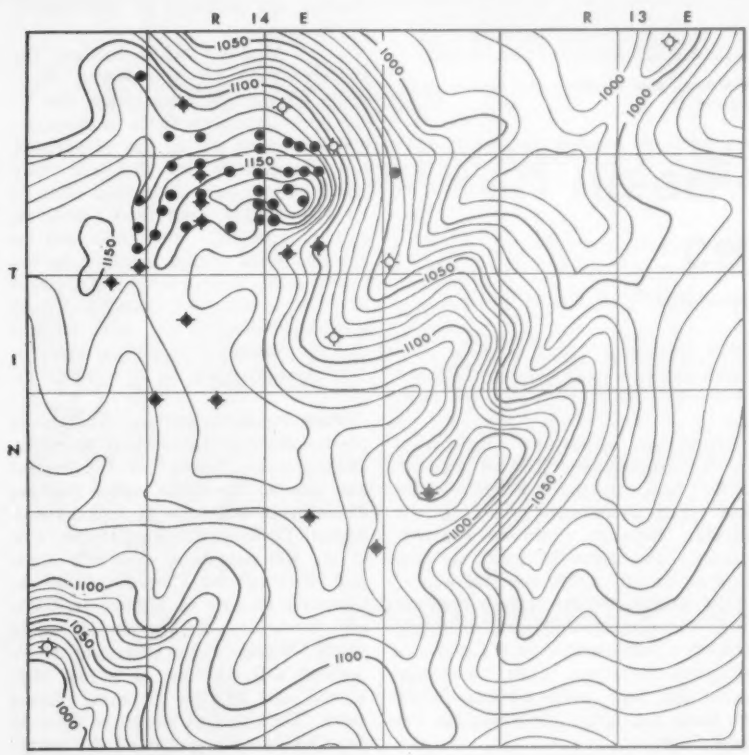
Interest flares in Forest City basin



HERE IS ONE of the nation's least tested basins—Forest City. New drilling may change all this. Fig. 1.

New drilling, new discovery mark action in two-state, border area

BY RICHARD F. SVOBODA



SURFACE STRUCTURE map uses the Burr lime of Permian age as the datum. The major axial trend of the Honey Creek anticline is generally northwest-southeast with maximum elevations reached in Dawson field. Fig. 2.

THERE IS new exploratory activity in the Forest City basin, one of the nation's oldest but least-tested petroleum provinces. Two wildcats in Richardson County, southeastern Nebraska, and a recent oil discovery, the 1 Currie, in Holt County, northwestern Missouri, may be the much-needed spark to get things going again in this forgotten oil prospect.

Humble Oil & Refining Co. is working in C SW NW 23-1n-14e, at 1 Shellenbarger, and Kirby Oil Industries, Inc., has location in Section 13. One of Kirby's rigs is currently drilling a two-well contract with Carter-Mandel Co. of Lubbock near Corning, Mo.

Humble's well was spudded April 27. KB elevation is 1,152 ft. Top of the Hunton was 2,423 ft. No Mississippian limestone was present. Slight shows of live oil were found in the top of the Hunton, but a drill-stem test yielded only a few feet of mud. The initial potential on the best Hunton well in Dawson field was only 55 bbl. per day, and, with a very tight lime, not much was expected. Top of the Viola dolomite was at 3,131 ft. where good oil shows were reported in samples. A drill-stem test of the first 10 ft. yielded a few feet of black oil with no water. Humble was coring the interval below the test zone on May 7. The oil in the Viola was found structurally lower than the oil-water contact of Viola oil in Dawson field. Kirby's well will begin about June 1. Contractor on the Humble well is Knight, Smith & Wise of Great Bend,

Kans. They will move the rig after completion of the 1 Shellenbarger to a direct offset southwest of the 1 Currie discovery well in Missouri.

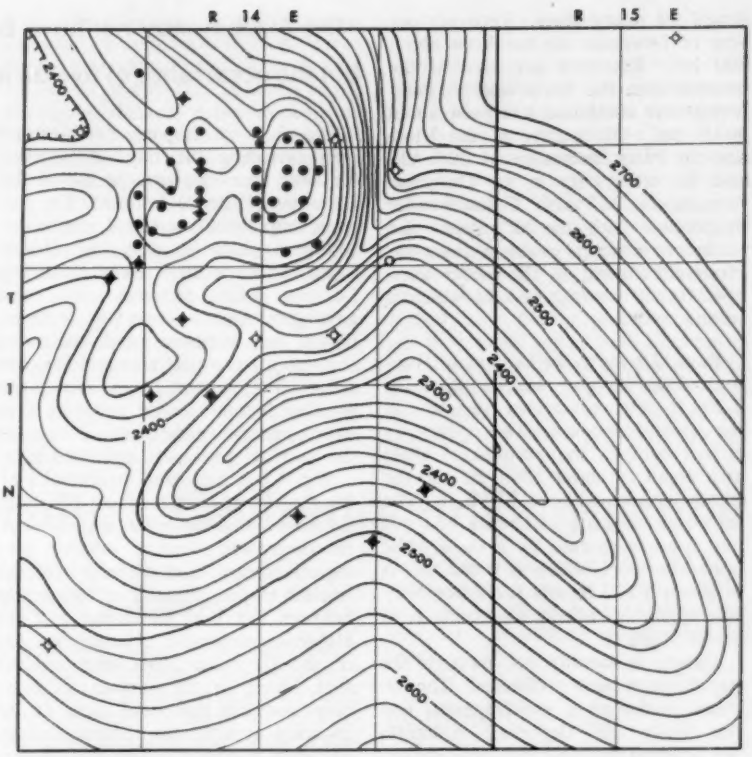
Inactive. Southeastern Nebraska's portion of the Forest City basin has been inactive for several years. A surface and subsurface geological study was conducted in Richardson County in an area between Dawson oil field and Livengood oil field of Brown County, northeastern Kansas. A surface geological structure map was compiled from Permian and Pennsylvanian limestone outcrops present in the area. All the exploratory wells and field wells were studied in detail to compile subsurface data for structural and isopach maps. Well samples, logs, and completion records for all wells are on file with the Nebraska Geological Survey at Lincoln. The development of structure in the prospect area revealed by the thickness changes of subsurface formations has an important bearing on potential oil accumulation. All that remains is an extensive wildcat campaign throughout the three-state area to give Forest City a lift into the oil ranks.

History of Exploration for Oil

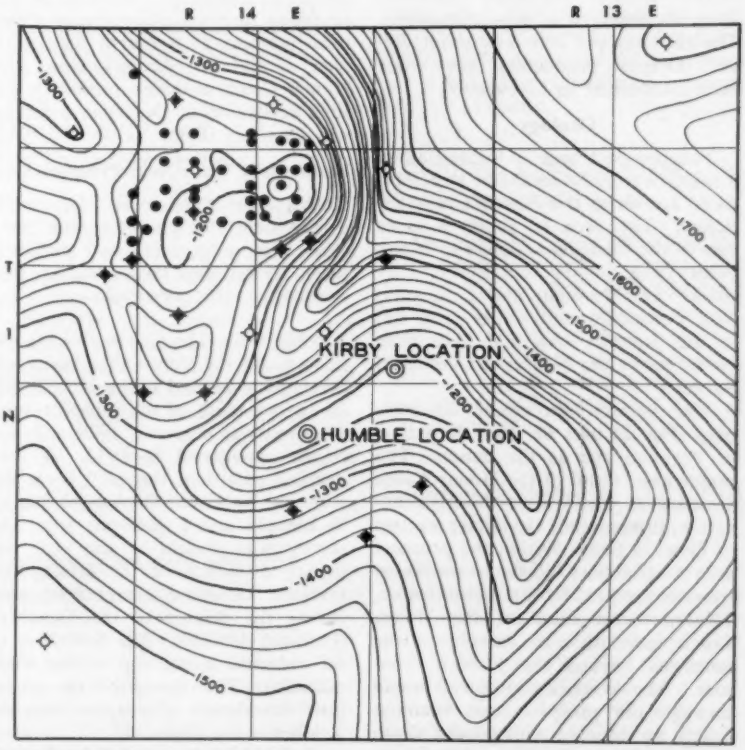
Oil was discovered in Dawson field in 1941 in the southeast quarter of 9-1n-14e within the Devonian (Hunton) dolomite at a depth of about 2,200 ft. Production of oil was established from the Galena (Viola) dolomite at a depth of about 2,900 ft. in 1942 in 10-1n-14e. Oil production from the St. Peter (Wilcox) sandstone at a depth of about 3,200 ft. was first established in 1952 in Section 11-1n-14e.

Southeast of the prospect area in Brown County, Kansas, oil was discovered in Livengood field from the Devonian (Hunton) dolomite at a depth of about 2,575 ft. in 1944. A third field not shown on the maps was discovered in 1953. It is about 3 miles northwest of Dawson field and is known as Snethen field. Production in Snethen is from the Viola dolomite at a depth of about 3,100 ft.

Production. Total production of oil from Dawson field since discovery has been about 1,150,000 bbl. Production from 12 wells during 1959 totals about 94,000 bbl. Nearly all the oil production is in the northwest quarter of 11-1n-14e. The Viola dolomite and St. Peter sandstone are the principal production horizons in Dawson field. Devonian (Hunton) dolomite oil production in Sections 9 and 10 of 1n-14e and in Sections 2, 3, and 4 of 1n-14e have produced about 220,000 bbl. of oil out of the total of 1,150,000 bbl. and have been aban-



THIS ISOPACH MAP reveals a broad northwest-southeast thinning over the Honey Creek anticline in a trend including Dawson, prospect area, and Livengood field. The map includes the interval between the Burr lime and the top of the Hunton. Fig. 3.



DEVONIAN MAP is based on deep well control, surface geological control, and the effect of the isopach map or thinning of formations between the Burr and the Devonian. Fig. 4.

doned for many years. Recovery per acre of Devonian oil has been about 500 bbl. Recovery per acre to the present from the Viola and St. Peter formations combined has been about 3,000 bbl. Oil gravity in the Viola and St. Peter formations is 29° API and the oil gravity in the Devonian formation is 24° API. Connate-water production with the St. Peter and Viola oil is not a problem since the dissolved content in the water averages 10,000 p.p.m., most of which is sulfate material.

Pays. Depth to the Devonian (Hunton) dolomite pay section is about 2,200 ft. Two pay zones are found in the Viola formation. The upper pay is just beneath the Maquoketa shale at a depth of about 2,900 ft. and the lower pay is at about 2,950 ft. The St. Peter (Wilcox) sandstone has two pay zones separated by a shale. The upper horizon, which is dolomitic, is at about 3,230 ft. and the lower horizon which is entirely sandstone is at about 3,260 ft.

Casing is usually set through the pay horizon and perforated. The St. Peter sandstone is sandfractured and the Viola and Devonian dolomites are acidized.

Livengood field, Brown County, Kansas, is located in Sections 3 and 4 of 1s-15e and has produced about 90,000 bbl. of oil since discovery from six wells. It is now abandoned. The recovery per acre was about 600 bbl. Deeper production has never been established in Livengood.

Geology

The prospect area is located along a major northwest-southeast structural trend known as the Honey Creek anticline. The area is about 9 miles east of the Nemaha anticline or Humboldt fault within the Forest City basin. The Permian and Pennsylvanian limestones and shales crop out in the prospect area and have been identified by the Nebraska Geological Survey.

The surface geological structure map (Fig. 2) uses the Burr limestone of Permian age as the datum. The major axial trend of the Honey Creek anticline is generally northwest-southeast with maximum elevations reached in Dawson field. Within the prospect area a subsidiary northeast-southwest trend is revealed by a structural nose. The northeast flank of the Honey Creek anticline dips sharply to the northeast beyond the 1,100-ft. contour. The northeast-southwest trend through the prospect area becomes highly accentuated with greater depth in the older subsurface formations where a closure separate from Dawson field is found.

"The 1 Albin may not have been a commercial oil producer but the occurrence of live oil in the area is an important fact."

Fig. 3 is an isopach or thickness map including the interval between the Burr limestone and the top of the Devonian (Hunton) dolomite. The isopach map reveals a broad northwest-southeast thinning over the Honey Creek anticline in a trend including Dawson field, prospect area, and Livengood field. Secondary thinning trends run northeast and southwest through the prospect area and Dawson field. The isopach map shows the positive feature in the prospect area which underlies the structural nose on the surface geological structure map.

Fig. 4 is a geological structural map for the top of the Devonian (Hunton) dolomite. The Devonian map is based on deep well control, surface geological control, and the effect of the isopach map or thinning of formations between the Burr limestone and the Devonian dolomite. Closure on top of the Devonian more than doubles that found in the surface structure map and the structural nose in the prospect area on the surface geological map becomes a separate closure on the Honey Creek anticline.

The structural position of the Viola and St. Peter formations below the Devonian (Hunton) dolomite would be found in a relatively similar structural position as found in the Devonian formation. Activity along the Honey Creek anticline preceding the final deposition of Devonian dolomite was relatively slight.

Exploratory Wells Near Prospect Area

The records of exploratory wells drilled near the prospect area were studied in great detail and pertinent facts concerning their drilling and completion are presented.

Albin well. The first well drilled in this area of the Forest City basin was the 1 Albin located in the NE SE NE 26-1n-14e south of the prospect area. The well was begun in 1929 and was finally abandoned in 1933. A very detailed record of this well is on file with the Nebraska Geological Survey in Lincoln and a geologist from the survey was present at the well site during a portion of the drilling operations. Oil shows were not reported during the drilling of the Devonian (Hunton) dolomite. The first show of oil occurred in the top of the Viola dolomite. The record of the geologists' description of samples from the 1 Albin is as follows:

- 3,010-20 ft., gray dolomite and chert in part oil-stained.
- 3,020-40 ft., gray and brown dolomite, crystalline, gray chert, oil-stained.
- 3,040-65 ft., gray and brown dolomite, some chert, common oil staining.
- 3,065-80 ft., light gray dolomite, in small part oil-stained.

The description of samples and oil shows from the St. Peter (Wilcox) formation is as follows:

- 3,447-49 ft., sandstone, show of oil.
- 3,453-56 ft., dolomite, trace of oil.
- 3,456-58 ft., dolomite, show of oil.
- 3,460-66 ft., sandstone, show of oil.
- 3,468-70 ft., sandstone, show of oil.
- 3,470-77 ft., sandstone, trace of oil.

The geologist described his term "show of oil" to mean a live oil which can be seen in the cuttings and a "trace of oil" to mean oil sufficient to discolor the sand.

The records show that the 1 Albin was swabbed and about 5 bbl. of oil was recovered, in a newspaper report of June 29, 1933. Another newspaper report states that the rig and equipment was totally destroyed by fire while the rig was shut down. The newspaper reports also indicate that the operators had trouble financing the venture, which in the main was with local people. The well was finally abandoned in 1933. The 1 Albin may not have been a commercial oil producer but the occurrence of live oil in the area is an important fact. According to the Devonian structural map the 1 Albin is low on the structure in the prospect area.

Huston well. The second well drilled near the prospect area is the 1 Huston located NW NE NW 26-1n-14e. The well was completed in 1952 to a total depth of 2,407 ft. with the top of the Devonian (Hunton) at 2,397 ft. The Viola and St. Peter formations were not drilled in the 1 Huston. According to reports in the file of the Nebraska Geological Survey, casing was run in the 1 Huston to a depth of 2,397 ft. to test an oil show. Commercial production was not established.

Stevens well. A third well completed in 1955 near the prospect area is the 1 Stevens located in SE SW 24-1n-14e and drilled to a depth of 2,585 ft. bottoming in the Devonian (Hunton) dolomite. The operator reports oil

shows at 2,449-50 ft. in circulated samples and shows of oil between 2,465-67 ft. Production casing was not run to test the oil shows.

The 1 Huston has a Devonian datum of minus 1,311 ft. which is 85 ft. structurally higher than the 1 Albin. The 1 Stevens has a Devonian datum of a minus 1,324 ft. which is 72 ft. structurally higher than the 1 Albin. Because of structural position, the 1 Huston and 1 Stevens should logically have been drilled to the Viola and St. Peter formations where good oil shows occurred in the 1 Albin.

Wittwer well. Northwest of the prospect area the 1 Wittwer located in the NW NW NE 22-1n-14e, completed in 1940, was drilled to a depth of 2,453 ft. bottoming in the Devonian (Hunton) dolomite. Oil shows were reported in the Devonian dolomite and production casing was run to 2,406 ft. The hole was bailed for 12 hours recovering water and a show of oil.

Morris well. In the NW NW NW 22-1n-14e, the 1 Morris, completed in 1955, bottomed in the Devonian dolomite at 2,331 ft. Minor shows of oil were reported with no production casing run.

In SW SE NW 15-1n-14e the 1 Messinger drilled in 1955 reached the top of the Viola formation for a total depth of 3,005 ft. Scattered stains and fluorescence were reported from the Devonian dolomite between 2,283-88 ft. and from 2,288-2,300 ft. At the top of the Viola dolomite formation from 2,989-92 ft. scattered black oil and odor was reported. Oil stains were also reported from 2,992-3,000 ft. Production pipe was not run to test this well because of the low structural position relative to Dawson field. The second pay in the Viola section which would have occurred at about 3,030 ft. was not drilled or tested.

A second well in NE NE SE 15-1n-14e, completed in 1955, the 1 Sandrock was bottomed in the Devonian dolomite at 2,366 ft. with no oil shows reported by the operator.

Edelman. A Precambrian well drilled north of the prospect area, the 1 Edelman located NW NW SE 14-1n-14e was completed in 1954. An asphaltic residue was reported in the St. Peter sandstone at 3,368 ft. The 1 Edelman is structurally lower than the 1 Albin and low on the north flank of the prospect area.

Based on investigation of wells in Dawson field the oil-water contact in the Devonian dolomite appears to be at about a minus 1,265 ft. below sea level. The oil-water contact would encompass the area underneath oil shows found in exploratory wells in Section 15 and 22 of 1n-14e. Oil shows in the Devonian (Hunton) dolomite occurred in the 1 Huston in 26-1n-14e and the 1 Stevens in 24-1n-14e with respective Devonian subsea data of 1,311 ft. and 1,324 ft. The logical conclusion to be drawn from this information is that oil occurrence in the area of the 1 Huston and 1 Stevens is associated with a separate and distinct structure southeast of Dawson field. Otherwise oil shows would have occurred in outlying Dawson field dry holes to a depth of minus 1,324 below sea level. Accordingly, a structural saddle is drawn between Dawson field and the prospect area.

Conclusion

A structural nose exists on the surface geological map in the prospect area which is accentuated into district closure on the prospective petroleum horizons. Three subsurface formations, the Devonian (Hunton), Galena (Viola), and St. Peter (Wilcox) produce oil commercially in the area and oil shows have been reported in one or more formations on the flanks of the structure in the prospect area. Wells drilled near the prospect area were not thoroughly tested or did not reach all potential horizons known to contain oil. Recovery per acre in the main part of Dawson field has exceeded 3,000 bbl. and is still producing.

Here's California drilling action

North California test reports gas shows

The most northerly wildcat drilled in California in recent years reportedly encountered good gas shows en route to its current total depth of 5,652 ft. where the operator was preparing to run logs. The well is Zephyer Oil Co. 1 Leon Oro Blanco located about 10 miles south of the coastal town of Eureka in Humboldt County. It is also about 3 miles northwest of the small, nearly depleted Tompkins Hills gas field, the most northerly oil or gas field in the state.

Double-duty well for Dunnigan Hills

Artnell Co. recently completed a well in the Dunnigan Hills gas field of Yolo County, California, as both a field extension well and a deeper pool discovery.

First, the well constituted a 1-mile southeast extension of the field's DuBois producing sand at 3,064-80 ft. Second, it was a new pool discovery when it tapped a commercial accumulation in the Arbuckle sand at 8,077-97 ft. The DuBois tested for 4 M.M.c.f.d. and the Arbuckle for 2,500 M.c.f.d.

Los Angeles city wildcat reports strong test

A wildcat being drilled virtually in the center of the old Salt Lake field in the west side of metropolitan Los Angeles reportedly flowed oil at a rate of 320 bbl. daily on a drill-stem test of an interval at 2,552-2,608 ft. The well, Buttram Petroleum Corp. 1 Gilmore, is slated as a deep test of the largely abandoned Salt Lake field. The drill site is on the former baseball diamond of the Hollywood Stars. The operator was drilling ahead after the DST.

Garrison City gas extended in California

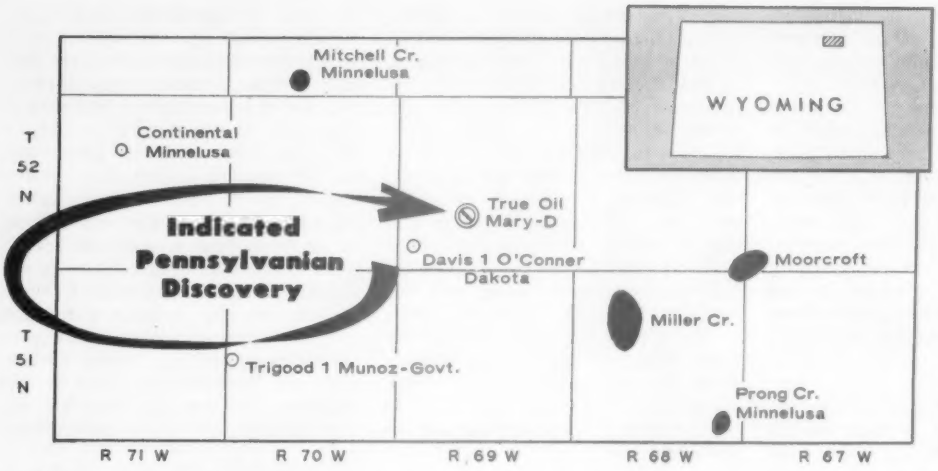
The Garrison City gas field in Kern County was extended ¾ of a mile northwest of the nearest field producer by a well completed by Carr and Wrath, operators. The Carr-Wrath well topped the Mulinia sand at 4,462 ft. Completion figures weren't available.

California's White Wolf yields new field find

A previously suspended wildcat 4½ miles south of the San Emidio field in Kern County has been completed as a new shallow field discovery. Shell Oil Co. went back into the suspended 8,245-ft. test, cleaned it out to 3,899 ft., sand fractured it, and completed it for 12 bbl daily of 14°-gravity crude.

Fillmore extension successful in California

Standard Oil Co. of California successfully extended production 1 mile north of the town of Fillmore and northeast of the Fillmore field with a well in SW NE 19-4n-19w, Ventura County. The Standard well, 3 Standard-Mobil-Arundell, was completed in the deep field at 14,678 ft. flowing 477 bbl. daily of 30.3°-gravity crude through an 18/64-in. choke.



IN northeastern Wyoming, the Pennsylvanian campaign picked up another indicated discovery at True Oil Co. 1 Mary-D, Campbell County.

Strike in Campbell County means . . .

New find for Powder River basin

ANOTHER Minnelusa Pennsylvanian discovery is indicated for Wyoming's northeastern Powder River basin country. The well is True Oil Co. 1 Mary-D in C NE NW 28-52n-69w, Campbell County.

A drill-stem test at 7,574-89 ft. got 610 ft. of 21°-gravity black oil and 90 ft. of oil-cut mud. Flowing pressure ranged from 0-350 psi. Final shut-in pressure was 2,700 psi. Top of the Minnelusa pay is 7,575 ft.

Location of this newest Minnelusa prospect is 8 miles southeast of Mitchell Creek Minnelusa field, a Trigood Oil Co. discovery of 6 years back. That well pumped 125 bbl. daily. Prong Creek field, a 1959 discovery, lies 12 miles southeast. Champlin Oil & Refining Co. opened that field last year for 500 bbl. per day on pump. No offsets have been as yet drilled. This new indicated success is located on a 25-mile northwest-southeast trend. Mitchell Creek is at the northwest end, Robinson Ranch on the southeast. Miller Creek on the trend produces from Dakota. (See Highlights page, this issue.)

Northwest of the True wildcat, Continental Oil Co. is at total depth 9,107 ft. at 9-1 Little Powder River Unit in SW SW 9-52n-71w. A drill-stem test is being made in the Minnelusa at 8,850-95 ft.

Rozet field. Superior Oil Co. 33-13 Colorado National Bank in NW SE 13-50n-70w, Campbell County, recovered 1,720 ft. of oil and 440 ft. heavily oil and gas-cut mud on test at 6,810-46 ft. in the Muddy. This well is on the east flank of Rozet Muddy Cretaceous field. It is the most easterly field location yet drilled.

Oil firms wary of "Canadianization"

THE APPLICATIONS for oil and gas-exploration permits in the Arctic Islands off Canada's north coast once added up to 142,000,000 acres, but it's a safe bet that only about one-third of that will be taken on by exploration and development firms come the end of May.

The new and very long-awaited Canadian Oil & Gas Regulations that were recently ratified by Canada's Dominion Government will definitely have their effect on cutting the actual number of permits taken out, and other factors will also combine to trim the record land-rush total. Companies that made application for Arctic Island rights early last year have had a full year or better to ponder their decisions. This fact, coupled with the initial exploration work and quick reconnaissance that took place in the interim, will take its toll.

Some sadness. The regulations have not been taken too kindly by most exploration firms, in particular some of the larger concerns that will be expected to do a large share of the initial exploration in the region. The regulations were made official on April 13. In the following 3 weeks, total permits taken out added up to 59 (about 2,500 were applied for) and only three companies or groups of companies have verified their original intentions with required deposits of hard cash. These 59 permits cover only 3.59 million acres, and represent only a minor amount in permit fees at $250 per permit.

No big change. The regulations governing permits in the Arctic Islands and Canada's northern onshore reaches have not changed to any large degree. However, when time comes for application for leases from the permits, which will be inevitable in the event of a major or commercial oil or gas strike, the Government has added several "Canadianization" clauses. These "overleaves," designed to insure that Canadian citizens have the chance to participate in development of Canada's natural resources in these regions, have drawn the ire of both major and independent operators. Most of the firms have thus far found Canada's stable political climate a very healthy place to work.

Strong words. Strong criticism of the regulations come from the Canadian Petroleum Association. Although Canadian independents that had hoped to "shop" their applications to more wealthy operators for exploration and development are not in a position to complain too bitterly, a number of them are concerned with the deterrent effect of the Crown's new offering. Should the formal applications for permits fall much below that anticipated by the Dominion Government officials, some clearing up of the regulations may be in order—and fast.

The regulations on the surface ap-

pear to be so loose-jointed that you could drive a truck through anywhere and this on its own has put many on special guard. The regulations to be fully workable will have to be much more explicit and take into account a few more of the facts of the region for which they must apply.

Despite the Canadianization theme of the regulations the first six permits taken out in the Arctic Islands were issued to William R. Sheeky, a New York financier. Sheeky took out permits 1-A to 6-A and these lands are on Amund Rignes and Ellef Rignes Islands.

Bulk of the 3.59 million acres taken out in the latter part of April was paid for by Round Valley Oil Co., Canadian independent backed by British capital. Round Valley on its own took out 50 separate permits on Cornwallis, Bathurst, and Melville Islands and then participated with Talent Oil & Gas, also a Canadian independent, in the acquisition of three other permits on Bathurst Island.

As May 27 is the final day for permit applications, this month end will tell many of the answers in the first round of oil and gas exploration in Canada's Arctic Islands. The permits that are being granted extend for a period of 6 years with two 3-year renewal periods applicable on each—12 years in all. Canada's Northern Affairs and National Resources officials are no doubt wondering just how far down the road will the first really significant oil and gas strike be on these far-northern reaches.

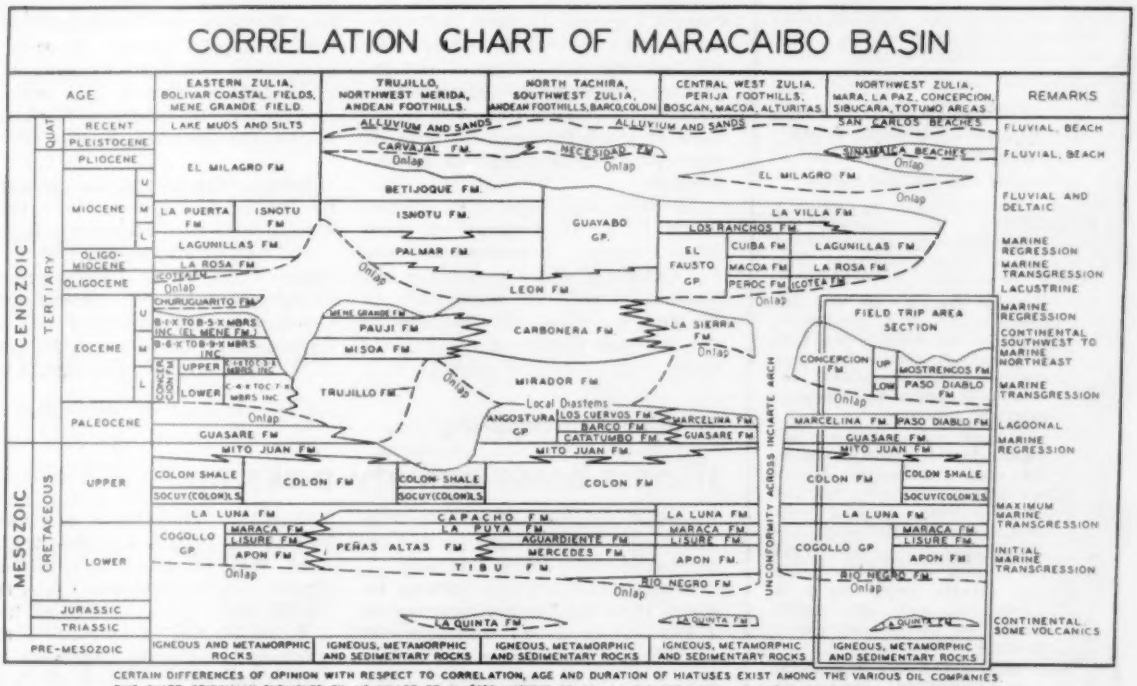
Lake Erie '60 action begins

IN ONTARIO, Place Gas & Oil Co., Ltd., started its 1960 field operation with action in both eastern and western sections of its Lake Erie gas and oil development.

Drilling of Place 12 Walpole on the company's 80-sq. mile gas-development acreage in the Selkirk area of eastern Lake Erie is now starting and installations of the oil-gathering pipeline system to the company's No. 1 oil producer in the Colchester area in the western sector of the Lake is well under way. Erection of an oil-storage tank battery and triplex pumping equipment to handle the company's Colchester oil production has been completed. Construction work on the new engineering field-office building and the pipe yard is making excellent progress.

● Floating platforms 2 and 3, now being modified to carry certain rotary-tool equipment for attachment to the standard cable-tool drilling rig, are expected to move into the Colchester area for the start of drilling operations later this month. The company will also move into its new office building and eastern sector operational base at Nanticoke this month.

Advising that a 15-well drilling target has been set for the current season's objective, the company states that the basic program calls for the drilling of 6 wells on the Colchester oil development acreage and 9 wells on its eastern gas development. All successful wells drilled will be immediately hooked up to the company's oil or gas-gathering systems. Place Gas & Oil is embarking on its third year of operation on the lake and now has offshore drilling equipment, barges, tugs, and auxiliary marine facilities, plus main offshore trunk lines already installed within its gas-gathering systems.



CERTAIN DIFFERENCES OF OPINION WITH RESPECT TO CORRELATION, AGE AND DURATION OF HIATUSES EXIST AMONG THE VARIOUS OIL COMPANIES THIS CHART, ORIGINALLY PUBLISHED BY J.B. MILLER ET AL (1958, HABITAT OF OIL, A.A.P.G. SPEC. PUBL., P. 606) WAS REVISED BY THE AUTHORS OF THE GUIDE BOOK IN FEBRUARY, 1960.

New guidebook

THE SOCIEDAD GEOLOGICA DE VENEZUELA OCCIDENTAL has released an informative guidebook of the recent field trip to Toas, San Carlos, and Zapara Islands. This book, edited by Rudolf Blaser, Cia. Shell de Venezuela, and Arthur N. Dusenbury, Jr., Creole Petroleum Corp., provides the plan and topical outline of the society's second field trip. Because of the complications of Toas Island geology and the varying details of its interpretation, the authors decided to insert three different maps of the island's areal geology in this book. The guidebook is well illustrated with maps, charts, and a complete correlation roundup of the Maracaibo basin.

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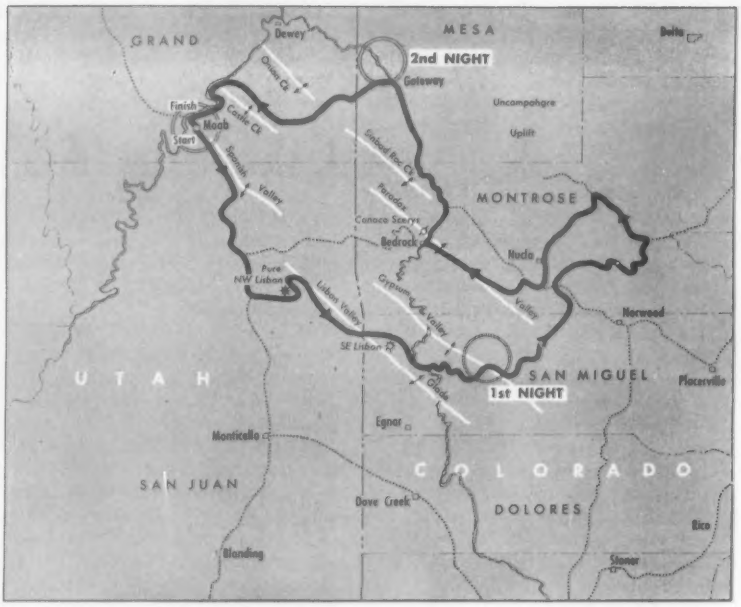

Three days and two nights will be spent on the road as . . .

Geologists slate Utah field trip

The Four Corners Geological Society will sponsor its third field conference on October 5, 6, and 7, 1960. All male members, students, and interested parties are invited to attend. Registration headquarters will be located at Moab Blueprint Co. with all registrations to be completed on October 4.

The trip will begin and end at Moab, Utah. The caravan will leave Moab October 5, returning late in the day October 7. This conference will make it possible for participants to see and study the salt anticlines in the northeast portion of the Paradox basin, and to observe such geologic features as the Uncompahgre uplift. Since this section of the Rocky Mountains is rapidly gaining in geologic importance, the field trip will take on added significance and interest. A visit will be made to Northwest Lisbon, the important discovery.

Busses. The society has arranged for the caravan to consist of glass-topped, wide-view, sightseeing busses.

For further information and application forms, please address request to: Registration Chairman, Four Corners Geological Society Field Conference, Ohio Oil Co. c/o Mr. Cole, 1211 Main Avenue, Durango, Colo.

With coming of spring . . .

Illinois basin activity picks up

ILLINOIS BASIN activity is back in the swing of things with spring conditions becoming more favorable.

In Spencer County, Southwest Indiana, H. C. Farmer is completing the 1 Eva Varner Gentry wildcat in SW SE NE 33-4s-5w, 1 mile east of Lincoln City. The well made 12 bbl. of oil per day from Aux Vases at 1,040-51 ft. Location is 1¼ miles from production.

In Gibson County, Indiana, 1 mile west of Princeton, Joe Labarber 1 Scott Littelpage, NW NW NE 14-2s-11w, tested 1,200 ft. of gas and 100 ft. of oil on test of the Cypress at 1,884-92 ft. Operator is now swabbing at this ¼-mile extension try.

In Western Kentucky's McLean County, Slagter Producing Co. is testing the Aux Vases at 2,370-82 ft. at 1 E. D. Fireline in 13-N-25, 1 mile southwest of Comer. Recovery was 180 ft. of clean oil and 70 ft. of mud-mixed oil on drill-stem test at 2,369-81 ft.

In Illinois' Clay County, F. L. Strickland 1 Hostettler, NW NE SW 1-4n-7e, flowed and pumped 150 bbl. of oil daily from McClosky lime at 2,954-64 ft. This well is 3 miles north of Sailor Springs.

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New Mexico test shows big Abo pay

MAJOR Abo reef production was found in Lea County, southeastern New Mexico. Discovery well is James P. Dunigan 1 Dennius in NE SE 33-17s-33e, 2½ miles southeast of Carper Drilling Co.'s Abo discovery and production in NE NW 31-17s-33e.

A test at 8,556-96 ft. got 33 bbl. of oil per hour on ½-in. choke. Test at 8,596-8,675 ft. got 60 bbl. of oil per hour on ½-in. choke. A third test at 8,676-8,712 ft. got 16½ bbl. of oil per hour on ¼-in. choke. Top of Abo reef is 8,571 ft.

Abo reef discovery flows in New Mexico

Eddy County in southeastern New Mexico has a new Abo reef discovery, 7 miles southwest of Maljamar and 18 miles east of similar production at Empire field. Discovery well is Sinclair Oil & Gas Co. 65-B Turner, an 8,500-ft. wildcat in 20-17s-31e.

A drill-stem test at 7,090-7,140 ft. got 16 bbl. of oil to tanks in 1 hour on ¼-in. choke. A test at 6,950-7,040 ft. surfaced gas in 5 minutes, distillate in 20. The well was then shut in for 35 minutes to move flow line. When tool was reopened, it flowed condensate during the rest of the test, no gage reported. Gas flow was 2,500 M.c.f.d. on ½-in. choke. Recovery was 200 ft. of condensate. This new discovery is inside Grayburg Jackson field.

Deep Ohio well finds some gas shows

In Ohio, Dalton & Hanna report their deep test 1 Arthur Eschtruth, Lot 14, Section 1, Ruggles Township, Ashland County, had a natural gas showing of 31,500 cu. ft. in the Glenwood at 4,422-26 ft. This section was treated with 1,500 gal. of acid and when no increase in open-flow volume was indicated, the section between 4,420-28 ft. was shot with 40 qt. of nitroglycerin. Again no increase was recorded and hole was abandoned at 4,441 ft.

The logs of this test show the Clinton sand being absent, the top of the Trenton at 3,743 ft. and the Glenwood from 4,380 to 4,432 ft.

The operators are moving the rig about 2,400 ft. southwest to a new location in the same township for another attempt to establish production in the deeper sediments on 1 E. A. Clouser, Lot 41, Section 1.

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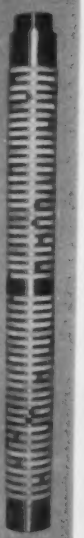

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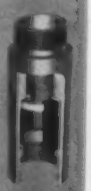

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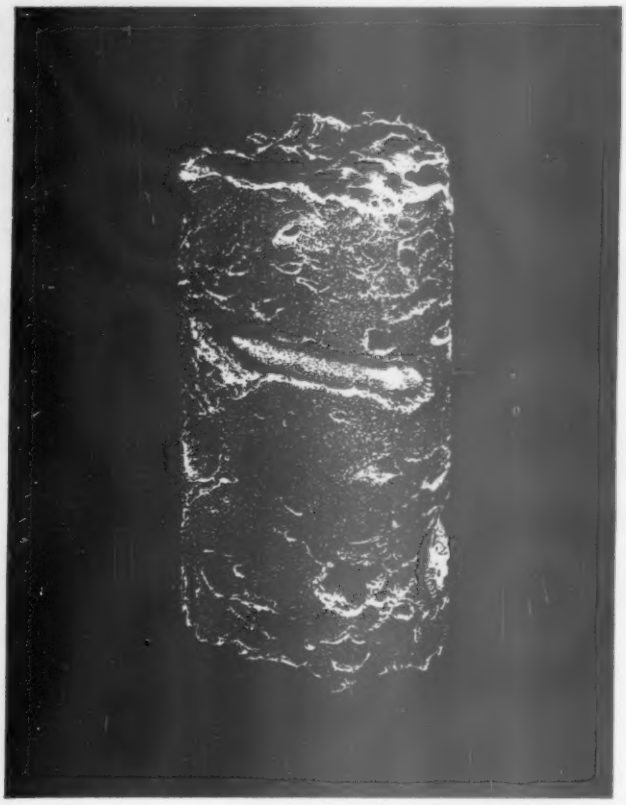

The Very Beginning

Sunniland Reef, Dade County, Florida: depth, 11,402 feet; thickness, dolomite section, 58 feet (total formation, 255 feet); permeability range, less than 0.1 md. to 2300 md.; porosity, 9.3%; residual oil, 4.0%; total water, 70.2%.

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Oregon leases new acreage

IN THE Pacific Northwest, Humble Oil & Refining Co. was recently issued a lease covering some 2,000 acres of Oregon State Game Commission lands in the Summer Lake game management area of Lake County, Oregon. According to Northwest Oil Report in Portland, the lease reportedly carries a directional drilling clause limiting drilling site to areas adjacent to the game management area. The lease was issued at the regular state-land rental fee of 25 cents per acre plus ⅛ override on royalties. Northwest Oil Report states that since this land is centrally located within the major 500,000-acre Humble lease block, this brings the company much closer to putting their land in shape for drilling.

Other news. In the Harney basin of Harney County, Oregon, Lee Crider will start moving in to drill in 24s-33e soon, according to reports. The well will be drilled in a 20,000-acre block which centers in 24s-33e. This block covers nonmarine sands and shales of the Pliocene Harney formation. There have been numerous gas shows in these rocks.

In Grays Harbor County, Washington, Sunshine Mining Co. bid successfully $1 per acre on May 2 for some 2,000 acres of county lands in the Ocean City area of 18n-12w.

In Polk County, Oregon, Reserve Oil & Gas Co. will drill to 6,800 ft. or top Mid-Eocene Siletz River volcanics (Metchosin) at the Amity area wildcat in 31-6s-4w. The well is on a north-south anticline. Colorado-Western Drilling Co. has contract.

McMullin Ranch find completed in California

The reported new gas field discovery by Great Basins Petroleum Co. in the McMullin Ranch, 5 miles north of Vernalis gas field, was confirmed by the completion of the wildcat. The well, 66-23 Signet-Whiting, was completed flowing 3,000-3,500 M.c.f.d. through a ½-in. choke from an Upper Tracy Cretaceous sand at 5,940-70 ft.

Oklahoma well hits

BIG Cherokee Pennsylvanian production was opened in northwestern Oklahoma's Major County at Livingston Oil Co. 1 State in SW SW NE 16-22n-11w, 10 miles northeast of Fairview.

The well flowed 960 bbl. of oil per day through open tubing from 6,544-6,602 ft. Operator also completed in the Manning Mississippian, regular field pay in the Northwest Ringwood gas area, flowing 15,690 M.c.f.d. This strike is another one of the important finds being tapped along the "Manning trend" that sweeps from Major down through Kingfisher County.

Fast drilling clip continues in Anadarko

The drilling pace in northwestern Anadarko basin of Oklahoma continues to quicken. In Cedardale field, Major County, Global Oils 1 Crail, C SE 18-22n-16w, flowed 4,400 M.c.f.d. after several tests in the Mussellem Pennsylvanian at 6,266-75 and 6,278-84 ft.

The field has extended across Woodward County in recent months and is now only 1 mile from West Campbell, a Hunton Siluro-Devonian field.

Texas County. Cities Service Oil Co. 1 Hier-A, C SE NW 21-5n-15eCM, second well in a new Morrow Pennsylvanian area inside Hugoton Permian field, had a calculated open flow of 60 M.M.c.f.d. without treatment from perforations at 6,128-38 and 6,148-50 ft. Hamilton Bros. discovered the pool.

Upper Morrow gas production is indicated at Hamilton Bros. 1-13 Hicks in C NW SE 13-5n-12eCM. The well flowed 5,210 M.c.f.d. and ½ bbl. oil per hour on tests at 6,064 ft.

Dewey County. Sinclair Oil & Gas Co. will go to 9,600 ft. to the Cherokee Pennsylvanian at 1 Pearl Kunc in C SE NW 14-17n-18w, south of the discovery well of West Valley Center field. It will be the field's fourth well. Gas comes from Tonkawa and Oswego.

Pennsylvania pool keeps fast pace

IN PENNSYLVANIA, development continues brisk in Boone Mountain pool. This field has been extended to the outskirts of DuBois. Of the six development gas wells reported, five were drilled in Boone Mountain pool. One well had a natural production of 25 M.M.c.f.d. with a rock pressure of 3,883 psi. Ten wells are now drilling in the southwestern extension of this field.

Westmoreland County. The discovery reported last month by Felmont Oil Co. on the Laurel Hill anticline, drilled on State Game Lands Tract 42, flowed 4 M.M.c.f.d. after acidization. Operator is now recementing 7-in. pipe.

Wildcat staked. Two significant wildcats were staked. Benedum-Trees has just announced a test in the extreme northern part of Washington County. It will penetrate the Helderberg limestone of Lower Devonian age. Two dry Oriskany tests were drilled in this area. The other wildcat is midway between Felmont's discovery on the Laurel Hill anticline and Johnstown field to the southwest on the same structure.

Cotton Valley oil tested in East Texas

Cotton Valley Jurassic oil was tested on drill-stem test at 9,735-54 ft. at Happy Gist 1 Grant Unit in Lavinia Moren Survey, A-681, 2½ miles southwest of Bivins in southern Cass County, East Texas.

The drill-stem test recovered 1,800 ft. of heavily gas and oil-cut water cushion and 90 ft. of mud and gas-cut oil, 60% oil. This possible discovery is 2¾ miles northeast of Cotton Valley production in East Linden field. Nearest well is Pan American Petro-

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leum Corp. 1 S. Sheldon, Joshua Turner Survey, A-1032. That 1959 well flowed 383 bbl. of oil daily on 28/64-in. choke from Cotton Valley perforations at 10,492-10,560 ft. It was also a Pettet producer at 6,908-48 ft.

South Tyler. The Paluxy oil discovery in South Tyler field, central Smith County, East Texas, was confirmed at Delta Drilling Co. 3 Willingham and Daniels on the M. M. Long Survey, A-562.

The well flowed 254 bbl. of 30.6°-gravity oil daily on 12/64-in. choke from perforations at 7,465-77 ft. This new producer is 4 miles south of Tyler on the southwest side of South Tyler field. It lies 214 ft. northwest of the discovery well completed last fall at 1 Willingham & Daniels. That Paluxy discovery flowed 278 bbl. of oil daily on ¼-in. choke from open hole at 7,470-80 ft.

Panhandle wildcat is New Morrow find

Morrow Pennsylvanian production was opened at a wildcat in Hansford County, Texas Panhandle, 9 miles north of Gruver, 1⅓ miles northeast of Shapely Morrow oil field, and 2½ miles northwest of Bernstein gas field.

Discovery well is Shamrock Oil & Gas Corp. 1 Royal C. Jackson "B" in Section 37, Block P, H&GN Survey. The well flowed 6,050 M.c.f.d. with a trace of oil, calculated open-flow potential. Perforations are at 6,900-10 ft.

Near Spearman. Texaco Inc. dually completed 2 E. M. Carmody "C," 8 miles northeast of Spearman, in the lower Oswego and Tonkawa Pennsylvanian.

Open flow from Tonkawa was 1,750 M.c.f.d. at 5,423-31 ft., extending production in Hansford Tonkawa gas field 3 miles southeast. Potential from the lower Oswego zone at 6,342-82 ft. was 132 bbl. of oil daily on 22/64-in. choke.

Remote Utah well is Dakota gas discovery

A remote wildcat in Uintah County, Uinta basin, Utah, flowed 5,200 M.c.f.d. from Buckhorn-lower Dakota Cretaceous perforations at 8,544, 8,566, and 8,580 ft. It is Texaco Inc. 1 Fence Canyon Unit in NE SE 36-15s-22e.

This new producer is 9 miles north of any production, that being Diamond Ridge unit, Grand County. There has been no drilling in a 5-mile radius of Texaco's well. At Diamond Ridge, Sunray Mid-Continent Oil Co. has perforated two Entrada Jurassic zones at 3 Diamond Ridge Unit in NW SE 25-17s-22e, Grand County. Casing was run to 7,626 ft.

A drill-stem test at 7,465-70 ft. got 50 ft. salt water. A test at 7,312-18 and 7,322-28 ft. got 4 bbl. salt water in 2 hours. Swab tests continue. Location is 2 miles southeast of the 2 Unit well in NE NE 23-17s-22e which flowed 1 M.M.c.f.d. from lower Dakota perforations at 7,254-84 ft. on completion several months ago.

Flowing Wolfcamp oil reported in Gaines County

Gaines County, Texas, has a new Wolfcamp Permian discovery. The well is G. S. Hammonds 1 Foster, 8 miles southeast of Seminole in the southern part of the county.

Hammonds' discovery flowed 215 bbl. of oil in 12 hours on test through ⅜-in. choke from perforations at 9,202-18 ft. It was also a lower Wolfcamp discovery at 9,406-89 ft., pumping 150 bbl. per day. Top of Wolfcamp reef was 9,200 ft. Location is in Labor 8, League 305, Dawson CSL Survey, 1½ miles southeast of Toby Jo field.

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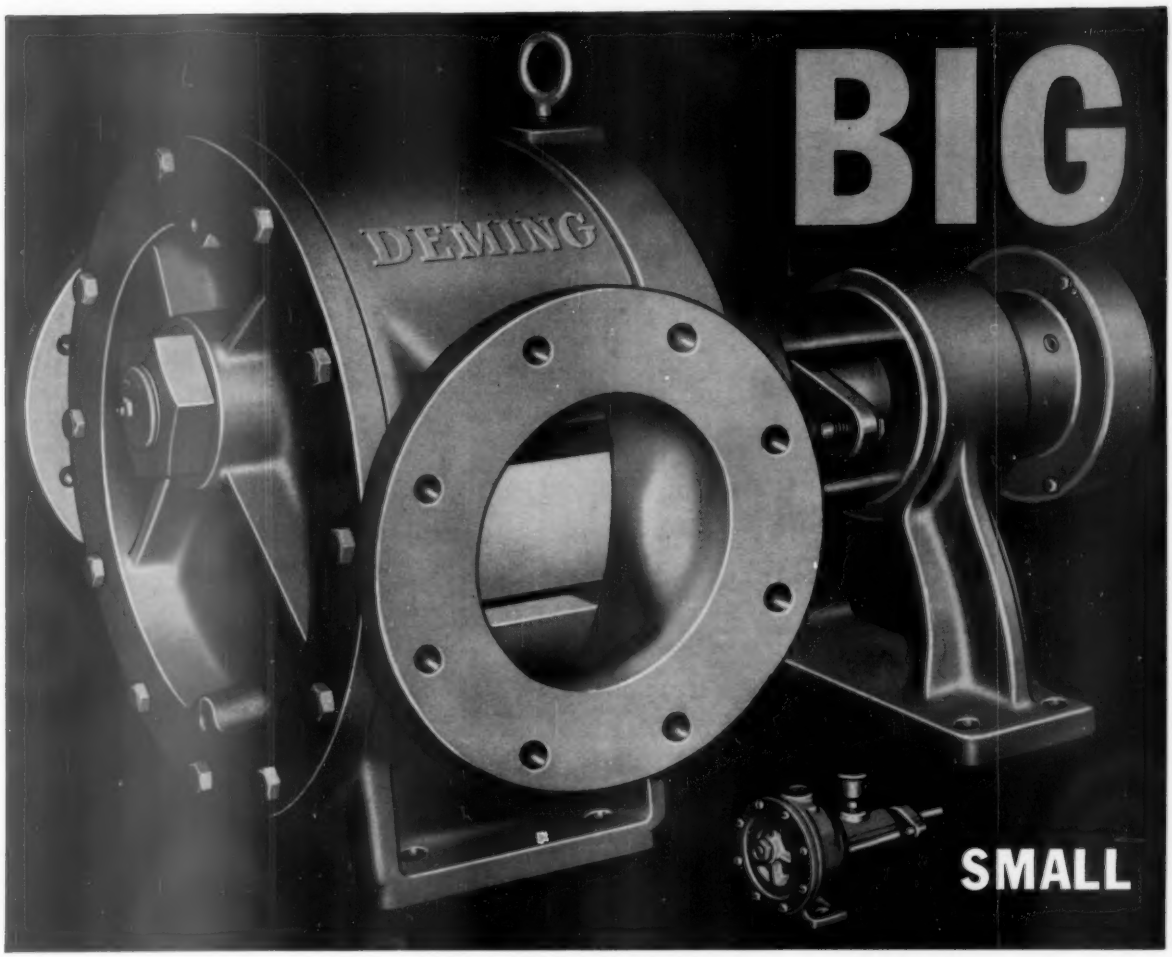

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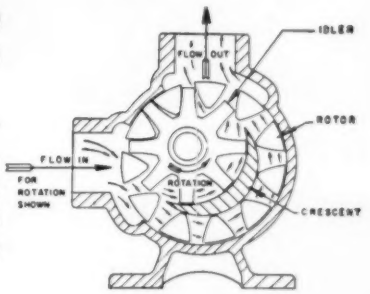

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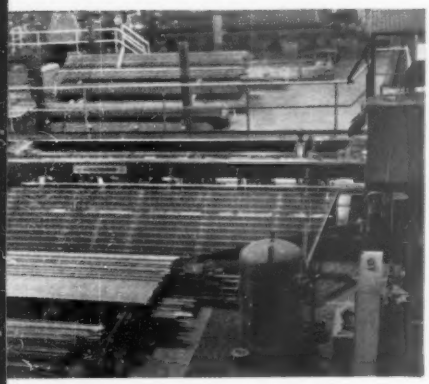
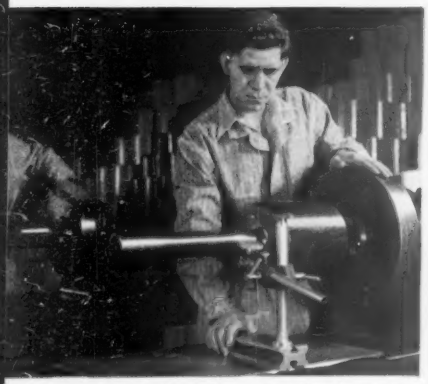


8 Five lengths of Jal-Con-Weld standard pipe undergo simultaneous pressure testing on this modern Schloemann hydrostatic tester.

9 Here Jal-Con-Weld standard pipe is being wound around a mandrel. This is another test of the ductility of the pipe and the strength of the welds.

10 This is a flattening test to determine strength of the weld, ductility and other qualities of the steel in Electricweld Line Pipe.



14 These inspectors are checking thread alignment on Buttress Thread Couplings. Proper alignment is essential to good stabbing and true spinning of casing joint.

15 Each length of J&L Quench and Temper high-strength casing is subjected to full-length magnetic particle inspection. The slightest surface defect is distinctly visible under the ultraviolet light.

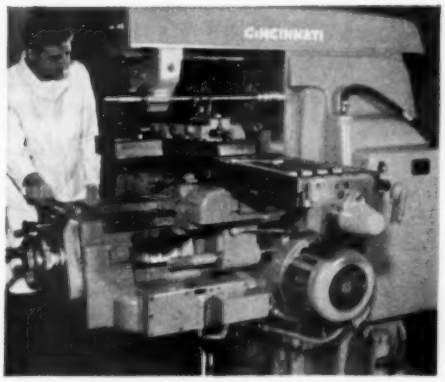
16 This inspector is testing the angle and diameter of the sealing member on pin end of Grayloc Tubing. All dimensional characteristics are checked for accuracy.

2 J&L inspectors are taking a steel sample from a basic oxygen furnace for thorough chemical analysis. A record of each heat is kept all through the manufacturing process.

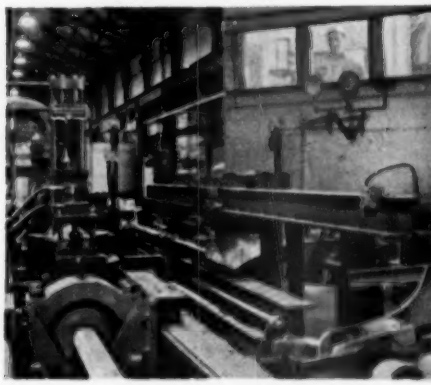
3 This Spectromet unit provides a simultaneous analysis of alloying elements in the J&L steel used for tubular products.

4 In a J&L laboratory, this metallographer is examining the structure of a steel specimen.

5 This J&L laboratory technician is testing a specimen cut from finished pipe to determine its compliance with specified yield, tensile and elongation requirements.

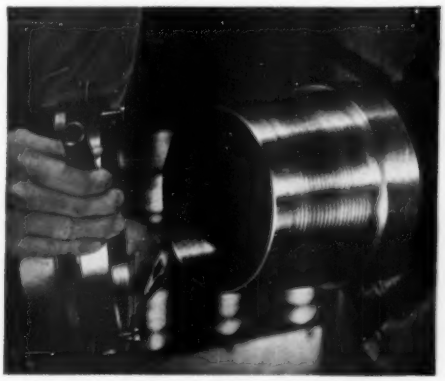


6 This milling machine operator is cutting the notch in a specimen for Charpy impact test. The Charpy test determines notch toughness of the steel.



7 This is the world's highest—pressure production tester. It is capable of applying hydrostatic pressures up to 20,000 pounds per square inch.

11 This skilled inspector is examining the internal surface and ends of J&L casing to insure further the final high quality of the product.



12 This is one of many dimensional measurement checks made on each joint of Extreme Line Casing (produced under license from National Supply Company).

13 Jones & Laughlin inspector, with surveyor-type transit, carefully checks thread alignment on integral joint drill pipe.

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17 Upset ends of Blue Ribbon and Blue Ribbon Vanadium Drill Pipe and P-105 grade tubing are shot blasted to provide clean surfaces for magnetic particle inspection.

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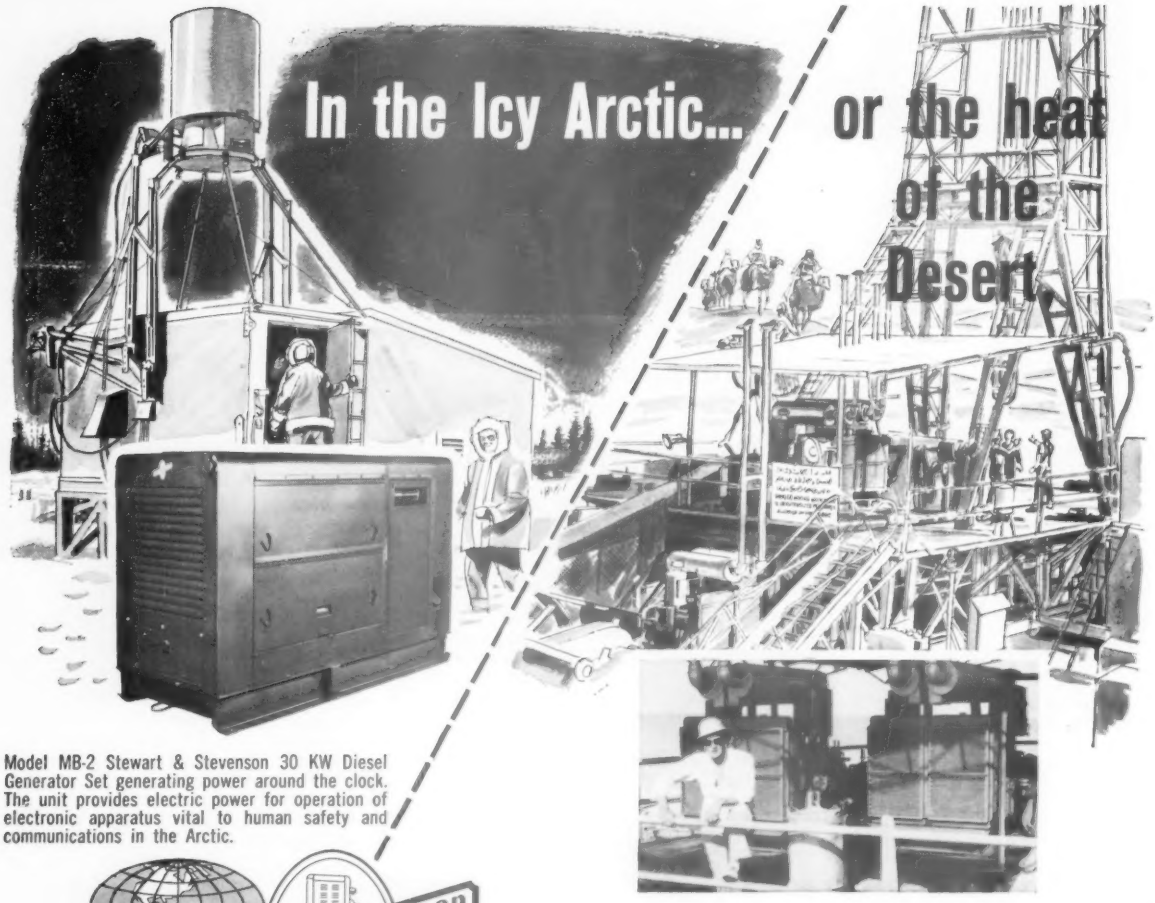

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Glorieta is new pay for West Texas field

Glorieta production was added to Ownby-Clear Fork Permian field in Yoakum County, West Texas.

The new-pay discovery is Shell Oil Co. 7 Earnest Ownby, 8 miles east of Plains. It pumped 151 bbl. of oil daily from perforations between 6,073 and 6,089 ft. This well was an upper Clear Fork discovery last year, flowing 313 bbl. of oil per day from that regular field pay zone. Location is in Section 502, Block 4, John H. Gibson Survey. In Andrews County, Shell 1 Brown is a Wichita Albany discovery in Block A-41 Ellenburger field, 12 miles southwest of Andrews.

The well flowed 178 bbl. of 35.1°-gravity oil plus 10% water in 24 hours on 24/64-in. choke from perforations at 7,266-7,518 ft. Location is in Section 20, Block A-41, PSL Survey.

Waddell discovery finaled in West Texas

A new pay for West Andector field in northwestern Ector County, 7 miles northwest of Goldsmith in West Texas, is the Waddell.

Discovery well is Condor Petroleum Co. 12-17 Cummins. It was completed from three zones. From Waddell, the new pay, it flowed 242 bbl. of 44.6°-gravity oil daily on 18/64-in. choke from perforations at 7,870-97 ft. From the McKee, second such producer in the field, it flowed 449 bbl. of 44.2°-gravity oil daily on 24/64-in. choke from perforations at 7,641-7,700 ft. From Ellenburger it flowed 552 bbl. of 44.5°-gravity oil daily on ½-in. choke from perforations at 8,026-36 ft. Location of this prolific three-zone producer is in Section 12, Block 45, T-1-N, T&P Survey.

Tannehill find finaled in Stonewall County, Texas

West Central Stonewall County in West Central Texas has new Tannehill production at a wildcat discovery 2½ miles north of Peacock. Discovery well is Roark, Hooker, & Roark 1 Earl Coplen in Section 296, Block D, H&TC Survey.

The well flowed 213 bbl. of oil per day on 16/64-in. choke from perforations at 3,482-92 ft. Top of pay is 3,480 ft. Gravity is 40.8°. Operators suggested South Carlile-Tannehill as the new field's name. Location is 2 miles south of Carlile Caddo field, and ½ mile east of a 5,758-ft. producing well. The 1 H. F. Metcalf, a confirmation to the discovery well, has 4½-in. casing cemented at total depth 3,590 ft. Oil sand was topped at 3,480 ft. This second producer is in Section 295, a north offset to the 1 Coplen.

Texas' Palacios field adds good producer

In Palacios field, Matagorda County, Gulf Coast Texas, Pan American Petroleum Corp. 1 C. G. Harvey "D", 8 miles northeast of the town of Palacios in the James McFarland Survey, A-358, Block 42.

The well flowed 226 bbl. of 35.8°-gravity oil per day on 12/64-in. choke from perforations at 9,065-75 ft. in the Melbourn E-4, Segment "E" zone. From the upper zone no potential is reported. Perforations are at 9,027-38 ft. in Frio.

Discovery wells

CALIFORNIA

Kern County:

Shell Oil Co. 52-5 KCL, NE NE 5-10n-21w, 12 BOPD, 14° gravity, 3.8% cut, TD. 8,245 ft. (New field discovery 4 miles south of San Emidio Ranch field.)

WESTERN CANADA

Alberta:

Devon-Palmer-Ren 14-31 Penhold, LSD 14, 31-36-27w4. Basal Quarts oil discovery. TD 8,258 ft.

Amax-Alcon 11-26 Crossfield, LSD 11, 26-28-2w5. Mississippian gas discovery. TD 8,399 ft.

Homestead et al. 11-15 North Sundre, LSD 11, 15-34-5w5. Mississippian oil discovery. TD 9,076 ft.

Skelly-Alta 10-36 Virginia Hills Q-1, LSD 10, 36-64-14w5. Beaverhill Lake oil discovery. TD 9,756 ft.

Pan American-B.A. 4-31 Swan Hills U-32, LSD 4, 31-65-10w5. Beaverhill Lake oil discovery. TD 8,635 ft.

ILLINOIS

Franklin County:

Shell Oil Co. 19 C. W. and F. Coal-Tract RS, NW¼ 36-6s-2e. IP 261 BOPD, 160 BWPD, Aux Vases 2,757-76 ft.; O'Hara 2,806-10 ft., McClosky 2,866-72 ft.; St. Louis 2,906-22 ft.; Warsaw 3,705-10 ft. TD 6,250 ft. Benton field deep discovery.

Madison County:

Edward C. Kock 1 Jakel, NW SW NE 29-4n-5w. IP 5 BOPD, 15 BWPD, Devonian 1,941-48 ft. TD 1,983 ft. Opens Highland pool.

KANSAS

Barber County:

Crescent Oil & Gas Co. 1 Rinke, SE SE NE 25-32s-14w. IPF 2,850 M.c.f.d., Miss. 4,552-58 ft. TD 4,607 ft. Opens West Palmer field.

Barton County:

Dunn-Gardner Drilling Co. 1 Musenberg, NE NW NW 2-19s-11w. IP 25 BOPD, 2% bw., 38°, Lansing-Kansas Miss. 2,746-47 ft. TD 2,800 ft. Opens Kleppernorth field.

Butler County:

J. P. Gaty 1 Ballard, C W½ SE SE 6-25s-3e. IP 47 BOPD, 8% bw., 40.1°, Miss. 2,746-47 ft. TD 2,800 ft. Open Ballard field.

Edwards County:

Crawford Oil & Gas Reserves Co. 1 Wood, SE SE NE 2-26s-16w. IP 12 BOPD, Conglomerate 4,368-76 ft. TD 4,460 ft. New field.

Ellis County:

Birmingham-Bartlett Drilling Co. 1 Nicholson "B", C N½ NE NW 18-13s-20w. IP 57 BOPD, 14% water, 36°, Lansing-Kansas City 3,647-54 ft. Opens North Herbert field.

Greenwood County:

Gerald H. Anderson 1 Wright, SE SE SW 27-24s-12e. IP 26 BOPD, Miss. 1,682-86 ft. TD 2,152 ft. Opens new field.

Harvey County:

Anderson-Prichard 1 Will, SW NW NE 10-23s-2w. IP 175 BOPD, 26° and 31.3°, Simpson 3,299-3,309 ft.; Hunton 3,156-62 ft. TD 3,416 ft. Opens West Halstead field.

Haskell County:

Helmerich & Payne 1 USA, C SE NE 15-27s-34w. IPF 1,466 BOPD, Morrow 4,981-86 ft.; St. Louis 5,088-5,101 ft. TD 5,240 ft. New field.

Falcon-Seaboard 1 Hopkins, C SW SW 34-30s-33w. IP 115 BOPD, 30.3°, Chester 5,410-18 ft. TD 5,700 ft. Opens Hopkins field.

Glickman Oil Co. and Benedict Oil Associates 1 Burch, SW NE SE 32-17s-1w. IP 25 BOPD, 700 BWPD, 37°, Miss. 2,656-66 ft. TD 2,735 ft. Opens Burch field.

Russell County:

Womer Oil Co. 1 Dreher, NW NW SW 23-11s-15w, IP 25 BOPD, 18% bw., 24.5°, Arbuckle 3,314-24 ft. TD 3,380 ft. Opens Dreher field.

NEW MEXICO

Eddy County:

Oscar Bourg Drilling Co. 1 State, 8 miles northwest of Maljamar in 2-16s-31e. IPF 75 BOPD, 2-in. choke, 36°, Premier 3,964-72 ft. TD 4,100 ft. PBTD 4,075 ft. New oil discovery.

Lea County:

Texaco Inc. 1-CH State of New Mexico, 26 miles southwest of Monument in 36-20s-32e. IPF 49 BOPD, 22/64-in. choke, 47.6°, 1,413 M.c.f.d., CP 1,000 psi., TP 600 psi. Atoka 12,640-54 ft.; IPF 114 BOPD, 1-in. choke, 53.4°, GOR 30,930:1. Morrow 13,242-66 ft. TD 14,816 ft. New oil discovery.

NORTH TEXAS

Archer County:

Hayden Farmer 1 Maxey, J. Longley Sur., A-780. IPF 382 BOPD, 16/64-in. choke, Miss. 5,250-60 ft. TD 5,265 ft. 41°. New oil discovery.

SOUTHWEST TEXAS

Calhoun County:

Brazos Oil & Gas Co. 1 J. J. Welder, 5 miles southeast of Seadrift in E. Hidalgo Sur., A-21. IPAOF 1,800 M.c.f.d., SITP 6054 psi., 54.4°, GLR 11,100:1. 9,300-ft. Frio 9,366-80 ft. TD 11,000 ft. New gas-condensate discovery.

DeWitt County:

Monsanto Chemical Co. 1 Belitz, 3 miles south of Yorktown in Stephen Best Sur., A-66. IPAOF 6,450 M.c.f.d., SITP 3,390 psi., 50.8°, GLR 50,760:1. Lower Wilcox 9,840-70 ft.; 1,850 M.c.f.d., SITP 3,354 psi. 50°, GLR 76,610:0. 9,716-34 ft. TD 10,517 ft. Dual gas-condensate discovery.

Jackson County:

Coastal States Gas Producing Co. 1

(Continued on page 179)

Walter Kuhn . . . hard work isn't unconstitutional.

Kuhn Picked for KIOGA Post

• New president of Kansas independents is a sharp, industrious operator who started as a tool dresser.

THERE'S STILL money to be made in the oil and gas business and new fields to be found—but not for a fellow who just wants to work an 8-hour day or sit in his office and wait for deals to come in.

Hard work and enterprise haven't been declared unconstitutional, are the words of Walter Kuhn, Wichita independent who is the newly elected president of Kansas Independent Oil and Gas Association. Kuhn, a wealthy operator who pioneered the vast Hugoton oil region in Kansas, succeeds C. L. Roberts of Russell, Kan., as leader of the strong organization of independents.

Kuhn has made a comfortable fortune since the day in 1920 when, as a 19-year-old farm kid from Illinois, he hired on as a tool dresser for Christy Brothers in Ranger, Tex. But he still hasn't forgotten some of the men who helped him along the way. He is proud of the fact that over the years he has been able to repay these favors by throwing good deals to some of these friends.

Ranger was a rough and tough spot for a teenager in 1920, but Kuhn proved he was willing to work hard and tend to the boss' business. This trait got him a job as tool dresser with Diamond Oil Co. at Salt Lake City, Utah, in 1921.

But the next year saw him back with Christy Brothers and Lee Wilson in the Breckenridge, Tex., boom, and he worked in this area of Texas for several years. He advanced to a driller in 1925 and in 1926 got into drilling contracting.

A cable-tool beginning . . . There's an interesting story about his entry into drilling. One day he went in to trade a car with D. H. Bolin, later a Wichita Falls independent. He proved himself such a sharp trader, Bolin remarked:

"A guy as sharp as you are should run his own tools. Why don't you get into contracting?"

Kuhn recalls he retorted: "I would if I had any money."

Bolin quickly replied, "I can get you financed."

And he was as good as his word. Bolin got Kuhn backing for a cable-tool outfit. Kuhn went right to work in Jack County and drilled 21 wells for Cole & Young out of Tulsa. He still numbers W. J. Young, veteran Tulsa independent, as one of his dear friends.

In 1929, Kuhn got into rotary rigs with his brother, Howard, and moved into the Hugoton area to drill for Benedum & Trees of Pittsburgh. A gas well in the region had blown out, caught fire, and burned for 2 years.

▶▶▶ Personals

W. A. O'Day, Baltimore regional manager for American Oil Co., will retire June 30 after 34 years with the company.

G. T. Bowen, division development geologist in Midland, Tex., for Standard Oil Co. of Texas, has been transferred to Houston as assistant to the chief development geologist.

George C. Palmer, production and reservoir engineer for Southwest Natural Production Co., Shreveport, La., has joined Butler-Johnson, Inc., Bossier City, La., drilling firm, as assistant to the president.

Sam A. Brown, Rocky Mountain region land superintendent for Continental Oil Co., has been promoted to regional coordinator of reserves and production acquisitions. **M. E. Thrash,** assistant regional land superintendent, will succeed Brown. **H. L. Dubuisson,** Houston, will succeed Thrash.

M. DeMalleray has been appointed general manager of PGAC Sahara, S.R.L., new French subsidiary of Pan Geo Atlas Corp., Houston. **Robert Ross,** formerly with the parent company in Lafayette, La., has been named operations manager for the French company's Sahara field activities. **John Robinson,** Odessa, Tex., has been named assistant operations manager, Algerian activities. **J. Lee Norman, Jr.,** assistant manager of Pan Geo Atlas' electrical logging department in Houston, has been assigned temporarily to Sahara operations. He will be in charge of field activities.

J. M. Zachary, executive vice president of Neville G. Penrose, Inc., Fort Worth, has been elected president of the company. He succeeds **Neville G. Penrose,** who has been named chairman. **John P. McNaughton** will succeed Zachary as executive vice president. Also, **Glenn G. Neill** has been elected assistant vice president; **Clem L. Ware** has been named assistant to the vice president; and **J. L. Tatum** has been named a director.

That occurrence had attracted the interest of the famed wildcatters.

Kuhn drilled some of the early Hugoton gas wells for such other gas pioneers as Moody & Seagraves, later to become Republic Gas, and for Panhandle Eastern Pipe Line.

Production deals . . . In 1930, Kuhn picked up his first private production when he drilled for Walter Sidwell. In the deal he acquired a quarter interest in the wells. From then on he concentrated on increasing his own production as well as doing contract drilling.

He sold out his tools in 1937 and moved to Wichita, still retaining his production interests. But 2 years later he bought another rig and remained in drilling until 1944. He finally decided that running a drilling business took too much time and had become too competitive. He could do better looking after his production interests.

Through the years, Kuhn has amassed good production in both oil and gas. He has a large ranch in western Kansas where Helmerich & Payne of Tulsa currently is directing a drilling-production operation that eventually will include 100 wells on Kuhn land.

Kuhn still retains the inner drive, the sharp-trading ability, and the desire to make friends that are hallmarks of his success. He was a little quizzical about his new KIOGA job when a Journal editor dropped into his Wichita office for a chat.

"Don't know why in the world they wanted me for this job," he said. "I can't make a speech or public appearances. But I'll try to get the job done."

And that's the answer. KIOGA members from experience know that Walter Kuhn will get the job done—he always has.

Charles L. McMahon, Jr., president of C. L. McMahon, Inc., Tulsa, has been elected chairman of the company. **Peter J. McMahon,** vice president and secretary, has been named president. **Richard W. McMahon** has been named secretary and will continue as vice president.

Robin J. Corbett, has been named manager of production for Sharples Oil Corp., Denver. He will continue as coordinator of producing activities. Corbett succeeds **Max S. Loy,** who recently resigned to open consulting offices in Chanute, Kans. **Lloyd O. Fox** has been named secretary-treasurer of Sharples. He succeeds **Wilbur A. Wiegand,** who has retired.

Donald H. McCrary, assistant gas analyst for Sinclair Oil & Gas Co. in Seminole, Okla., has been promoted to intermediate petroleum engineer in Tulsa.

Harold J. Conrad, exploitation engineer with Shell Oil Co., has been transferred to Kilgore, Tex., from Houston.

Dr. C. C. Oldenburg has been appointed senior research engineer in the chemicals process research section of California Research Corp.'s Richmond, Calif., laboratory.

Elmer R. Bradley, manager of Sun Oil Co.'s middle Atlantic sales region in Philadelphia, has been named assistant general sales manager for the company. **John K. McKee,** manager of the Ohio Valley sales region, will succeed Bradley. **Emory M. Osgood,** assistant manager of the central sales region, Pittsburgh, will succeed McKee in Cincinnati.

Adin A. Nellis, Jr., superintendent of quality control at Chemstrand Corp.'s Decatur, Ala., acrylic fiber plant, has been promoted to manager of overseas technical services. **Dr. Rolf Buchdahl,** formerly with Monsanto Chemical Co. and Sun Chemical Corp., has joined Chemstrand as director of basic research, Chemstrand research center.

Donald F. Clugston, manager of Vickers Petroleum Co.'s Nebraska-Iowa sales division, has been appointed general manager, branded sales. **Robert A. Kent,** executive vice president and general manager of Kent Oil Co., a Vickers subsidiary, has been named general manager, unbranded sales. Kent and Clugston will headquarter in Wichita. Also, **D. L. Anderson,** wholesale sales manager, has been named manager of supply and distribution. **C. R. McPherson,** retail sales manager, has been named director of marketing services.

Dr. James H. Lum, director of research and development for Monsanto Chemical Co.'s organic chemicals division, has been appointed director of technology, a new position. **Monte C. Throdahl,** director of development, has been appointed director of research for the organic chemicals division. **L. Edward Klein,** assistant director of development, will succeed Throdahl. **Dr. Ferdinand B. Zienty,** director of research, has been appointed director of a newly created staff function of advanced organic chemicals research within the division's research department.

▶▶▶ Personals

Berry M. Johnson, engineer with Pan American Petroleum Corp., has been transferred to Monahans, Tex., from Wink, Tex.

Dr. James F. Black and **Dr. Horace W. Gerarde** have been named senior research associates for Esso Research & Engineering Co.

W. Chalmers Burns, president and a director of Hartol Petroleum Corp., a subsidiary of Tennessee Gas Transmission Co., will retire May 31. Burns was president of Richfield Oil Corp. of New York before joining Hartol.

Richard R. Anderson, administrative assistant to the production vice president of Sun Oil Co., has been appointed director of production for Sun. He succeeds **Kingsley V. Schroeder,** who recently was named vice president in charge of domestic and Canadian production activities.

ANDERSON

J. Dwayne Taylor, assistant regional geologist for Venezuelan Sun Oil Co. in Caracas, has been named assistant to the director of foreign production operations. **Thomas F. Ritter,** district geologist for Bolivian Sun Oil Co. in Cochabamba, Bolivia, has been appointed assistant to the geological counselor for foreign operations. Taylor and Ritter will headquarter in Philadelphia. Anderson has been with Sun since 1938. He was assistant regional superintendent in Lafayette, La., before moving to Philadelphia as administrative assistant.

C. K. Seaman, Jr., district superintendent in McCamey, Tex., for Humble Oil & Refining Co., has been transferred to Midland, Tex., in the same capacity. The McCamey district office has been closed and most of its territory will be handled by the new Midland district. Others moving to Midland include **C. M. Boatman,** McCamey, who will be district operations superintendent; **W. H. Crowe,** Houston, district engineering supervisor; and **H. A. Weeks,** Snyder, Tex., district production engineer. **J. R. Dublin III,** Midland, will be district reservoir engineer, with **A. C. Evans,** Midland, as senior engineer. **J. R. Murdock,** McCamey, will be associate engineer. **J. W. Sauer,** McCamey, will be junior engineer. **B. A. Belknap,** Midland, is production geologist.

▶▶▶ Personals

SPECKHARD

Walter H. Speckhard, area geophysicist for British-American Oil Producing Co., has been promoted to manager of the southern exploration division. He will headquarter in Houston. Speckhard succeeds **F. S. Goerner,** who has resigned to become a consultant. Speckhard joined the company in 1955 as division geophysicist in Oklahoma City. He had been area geophysicist in Dallas since 1957.

L. H. True, president of Magnolia Pipe Line Co., has been named a director of Wyco Pipe Line Co., Denver. Wyco Pipe Line is jointly owned by Socony Mobil Oil Co., Inc., Texaco Inc., and Standard Oil Co. (Ind.).

Harold Spitzer, chief gauger for Western Crude Marketers, Inc., a subsidiary of Dakamount Exploration Corp., has been named superintendent of field operations. He will headquarter in Sterling, Colo. Spitzer was with Toronto Pipe Line Co. before joining Western Crude Marketers.

Gilbert V. Rohleder, vice president, operations, for Okan Pipeline Co., has joined the new Mid-America Pipeline Co. as general superintendent in charge of operations. Rohleder was with Service Pipe Line Co. before joining Okan in 1955.

L. M. Ream, Jr., has been appointed manager of Atlantic Refining Co.'s economics department. Name of the department will be changed to the coordinated planning and economics department.

Fred A. Westphal, head of the petroleum products department at the Bayway refinery of Humble Oil & Refining Co.'s Esso Standard Division, Linden, N. J., has been named assistant operations superintendent. **Al Sitarski,** head of the mechanical department, will succeed Westphal. **Jack Grady,** head of the maintenance and construction division, will succeed Sitarski. **James Driscoll** has been named assistant to the head of the mechanical department, and **John Van Schen** has been named assistant to the head of petroleum products. **Jack Hooton** has been named assistant to the head of engineering and procurement.

G. A. Naert, advanced petroleum engineer with Ohio Oil Co. in Midland, Tex., has been transferred to Bay City, Tex., as district engineer.

E. E. Heiser, area geologist for Pan American Petroleum Corp. in Casper, Wyo., has been promoted to Casper district geologist.

Ben Johnson, tool pusher with Parker Drilling Co. has been promoted to assistant drilling superintendent for the Oklahoma division.

John Sabot, a project manager for Goodrich-Gulf Chemicals, Inc., has been appointed coordinator of manufacturing operations for the company.

James R. Murray, managing director of Hudson's Bay Co., and **Milton Foley,** president of MacMillan, Bloedel, & Powell River, Ltd., have been elected directors of Hudson's Bay Oil & Gas Co., Ltd., Calgary.

Floyd B. Odlum, chairman, chief executive officer, and a director of Atlas Corp., has retired. **David A. Stretch,** president, will succeed Odlum as chief executive officer. Odlum founded Atlas Corp. in 1923.

Sidney A. Parkans, vice president and manager of exploration for Christie, Mitchell, & Mitchell, has opened offices as consulting geologist in Houston. Parkans was with Gulf Oil Corp. before joining Christie, Mitchell, & Mitchell.

R. A. (Bob) Keller, division manager, and **D. F. Bugge,** division chief clerk for Rowan Drilling Co., Inc., have been transferred to Casper, Wyo., from Williston, N. D. The move establishes Rowan's Rocky Mountain division headquarters in Casper.

C. Stribling Snodgrass, of Snodgrass Associates, Washington, has moved his headquarters to London where he will continue as a consulting engineer, specializing in oil and gas processing, transportation, and utilization. Before World War II, Snodgrass was managing director of Snodgrass, Perrin & Co., Ltd., in London.

C. W. Rackley, senior process engineer at Tennessee Oil Refining Co.'s Chalmette, La., refinery, has been promoted to assistant chief engineer of the company in Houston. **A. R. Dudley, Jr.,** senior process engineer in Houston, will succeed Rackley in Chalmette. **A. E. Bynum,** junior engineer in Chalmette, has been promoted to assistant process engineer there.

W. R. Sittig, reservoir engineer for Shell Oil Co., has been transferred to Abilene, Tex., from Wichita Falls, Tex.

William B. Macey, vice president of Western Development Co., Santa Fe, has been elected president.

Ralph V. Johnston, assistant district manager, sales, for Phillips Petroleum Co. in Denver, has been named vice president, sales, for Frontier Refining Co.

M. L. Crow has been named staff engineer, technical division, at Humble Oil & Refining Co.'s Baytown, Tex., refinery. **W. N. Lyster** has been named senior chemical engineer, and **E. M. Simmons** has been named foreman of the physical testing laboratory, technical division.

Bill O. Andress, head of Blackwell Oil & Gas Co.'s geological department, has been elected 1960-61 president of Tulsa Geological Society. Other new officers are **A. L. Kidwell,** Jersey Production Research Co., first vice president; **James E. O'Brien,** W. C. McBride, Inc., second vice president; **James H. Moore,** Schermerhorn Oil Corp., secretary; **Calvin J. Sutterfield,** Sullivan & Leroux, treasurer; and **Lyman C. Dennis,** Graybol Oil Corp., editor and chairman of the publication board. The society granted an honorary membership to **Howard Clark,** Tulsa consultant, last week, and presented outstanding student awards in geology to **Albert E. Becher,** University of Tulsa, and **Gale K. Billings,** Oklahoma State University.

ANDRESS

F. E. Schoonover, Monterey Oil Co., has been elected chairman of the Pacific Coast district of API's Division of Production. He succeeds **J. N. Gregory,** Calgary. Other new officers are vice chairmen: **C. M. Shields,** Standard Oil Co. of California; **Jack Fillman,** Shell Oil Co.; **E. E. Nichols,** Richfield Oil Corp.; and **C. K. O'Neill,** Gardiol, Inc. Citations for service presented at the Pacific Coast API meeting last week went to **S. J. Dickey,** retired president of the old General Petroleum Corp.; **G. H. Smith,** Union Oil Co.; **J. N. Gregory,** Beaco, Ltd.; and **T. O. Roe,** Halliburton Oil Well Cementing Co. A certificate of appreciation was presented to **Paul Andrews,** Signal Oil & Gas Co.

G. W. Butler, deputy coordinator of marketing for Standard Oil Co. (N. J.), has been appointed coordinator of worldwide marketing activities. He succeeds **M. W. Johnson,** who recently was named regional coordinator for the company's Latin American interests. **E. F. Choppen,** a director of Esso Petroleum Co., Ltd., will succeed Butler as deputy coordinator of marketing. Butler has been with Jersey Standard and its subsidiaries since 1929. He has been Jersey Standard manager of marketing development, assistant coordinator of marketing for North America and Africa, and was assistant general manager of marketing for Esso Standard Oil Co. before taking the deputy coordinator post last year.

BUTLER

Frank C. Rylands, executive director of Iraq Petroleum Co., has been appointed chief representative in Iraq for the company. He will continue to hold his London position. In Iraq, Rylands succeeds **R. G. Searight,** who has returned to Shell Petroleum Co., Ltd., in London.

David L. Matthews, manager of manufacturing for Goodrich-Gulf Chemicals, Inc., has been appointed vice president, manufacturing. Matthews will be responsible for production facilities at Port Neches, Tex., and Institute, W. Va., and for design and construction engineering activities of the company.

Dr. John P. Longwell, head of Esso Research & Engineering Co.'s solid rocket-propellant research program, will head a new basic research unit formed by the company. The new unit will be concerned with broad investigations in new areas which may have potential long-range application to petroleum science.

R. E. Hyzer, chief chemist for Petro-Tex Chemical Corp., has been named technical superintendent for the company. **C. M. Tidwell** will succeed Hyzer as chief chemist.

D. C. Wimberly has been named technical assistant to the vice president, petroleum products research department, for California Research Corp. in San Francisco. He had been with Standard Oil Co. of California, Western Operations, Inc.

James K. Bryant has joined Zapata Canadian Petroleum Corp. in Calgary as chief geologist. **Edward Gasior** has been named production superintendent. **Roy J. Winchester** is general manager in charge of Canadian operations.

Troy C. Kadel, district production superintendent for Sinclair Oil & Gas Co. in Casper, Wyo., has been transferred to Drumright, Okla., in the same capacity. He succeeds **John B. Rowland,** who recently retired. **H. A. Lund,** assistant district production superintendent in Casper, has succeeded Kadel.

William B. Belknap, Phillips Petroleum Co., has been elected president of Society of Professional Well Log Analysts. He succeeds **Frank S. Millard,** Carter Division of Humble Oil & Refining Co. Other officers are **J. Henry Blackburn,** Sunray Mid-Continent Oil Co., first vice president; **Ray L. Braeutigam,** Sinclair Oil & Gas Co., second vice president; **L. Guy Huntley,** Humble, Carter Division, secretary-treasurer; and **Anthony V. Messineo,** Atlantic Refining Co., editor. New officers will be members of the executive committee along with members-at-large, **R. G. Hamilton,** Tulsa consultant; **Paul W. Hull,** Standard Oil Co., of Texas; and Millard, an ex-officio member. Honorary memberships in the society were presented to Millard and Hamilton at the group's recent annual meeting. The awards were made for service to the society.

▶▶▶ Personals

Voris G. Johnston, production foreman for Texaco Inc. in Velma, Okla., has been promoted to field foreman and transferred to Maysville, Okla.

Glenn Purcell, plant manager for Shell Chemical Corp. in Houston, has been elected president of Texas Chemical Council.

Reid W. Bond, retired Shell Oil Co. vice president, has opened consulting offices in Tulsa. Bond was vice president in charge of Shell's Tulsa area before it was consolidated into the Denver area last year.

L. F. Kihneman, Jr., geophysical supervisor in Mobil Oil Co.'s New Orleans office, has been named district geophysicist there.

Stanley G. Hardison, Amarillo, Tex., consultant, has joined Monsanto Chemical Co.'s Lion Oil Division as southwestern region exploration manager in Midland, Tex. He will be in charge of exploration in the Midland, Amarillo, and Oklahoma City districts. Hardison was with Kerr-McGee Oil Industries, Inc., before becoming a consultant.

James D. Berry, Jr., a director of Quaker State Oil Refining Corp., has been elected chairman of the board. He succeeds **G. B. Hunter,** who has resigned as chairman but will continue as a director.

Dr. Paul G. Carpenter, executive vice president of Copolymer Rubber & Chemical Corp., has been elected president. He succeeds **A. K. Walton,** who has been named chairman. Carpenter was with Phillips Petroleum Co. before joining Copolymer in 1956.

▶▶▶ Deaths

Fred B. Branson, 65, retired comptroller for Gulf Oil Corp., died May 13 in a Fort Lauderdale, Fla., hospital. Branson retired last year after 25 years with Gulf.

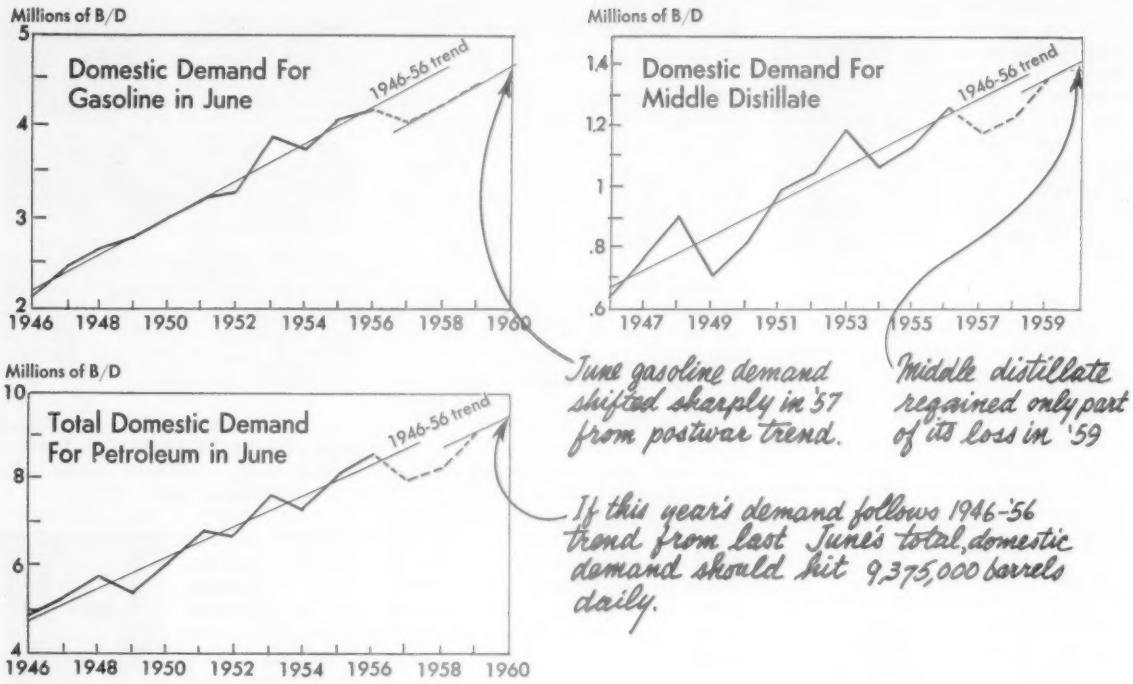
Harry B. Hilts, 64, executive secretary of Empire State Petroleum Association, died May 15 at his farm in Pipersville, Pa. Hilts was chairman and founder of Petroleum Industry Research Foundation, Inc., and was a member of the National Petroleum Council.

Victor N. Martin, 85, retired independent operator, died May 9 in Tujunga, Calif.

John F. Cailloux, Sr., 70, retired founder of American Iron & Machine Works, died May 16 in a Tulsa hospital. Cailloux became ill with pneumonia while touring Europe. After a month in a Paris hospital, he returned to Tulsa a week before his death.

Robert L. Kelley, 39, coordinator of production accounting for Sun Oil Co., died May 12 in a Norristown, Pa., hospital.

Spencer Black, 50, Dallas independent, died May 14. Black apparently suffered a heart attack while flying to Dallas.



Demand gains shift from per cent to volume

BY JOHN C. CASPER

FOR MANY YEARS demand for petroleum products increased at an average rate of about 6% a year. The gains in the postwar period have shifted more toward a constant volumetric addition rather than a constant percentage gain.

This change shows up in a study of the postwar trend of domestic demand for petroleum products in June. In addition to the slowdown that shifted from geometric to arithmetic progression, there was a big drop below the trend line in 1957 that has not been regained.

Let's start with gasoline. From 1946 through 1956, domestic demand for gasoline in June gained about 211,000 bbl. daily per year. Note that the only important variations from the trend were in 1952 and 1953.

'57 Loss Not Recouped

There was a sharp drop from this postwar trend in June 1957, and figures for the past 2 years indicate that gasoline has returned to its normal volumetric gain but has not made up for the 1957 loss.

If the demand gain is normal this year, domestic demand for gasoline will average about 4,670,000 bbl. daily next month. This total will include a little more than 15,000 bbl. daily for Hawaii which was listed last year as an export.

June is the off season for distillate fuels, and this fact accounts for the wide year-to-year fluctuation in distillate demand during this month. Sharp drops in 1949 and 1954 seem to indicate more influence from industrial and commercial activity than from variations in purchases of heating oils.

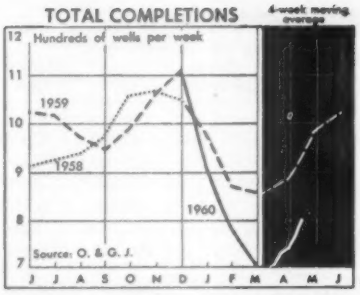
There was a sharp drop in June distillate demand in 1957, followed by another poor month in 1958. The sharp recovery in 1959 failed to bring the total back up to the 1946-56 trend line.

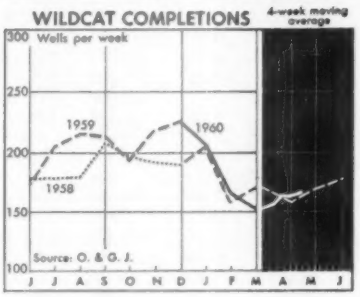
If the June gain in middle-distillate demand this year follows the postwar trend and adds 56,000 bbl. daily to last June's demand, the average for the month will be 1,420,000 bbl. daily.

Chart 3 shows domestic demand for all oils. The average annual increase shown by the trend line is about 360,000 bbl. daily. If next month's domestic demand shows this normal trend gain, the total for the month will be about 9,375,000 bbl. daily for an increase of 4% over June 1959.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,799,560	UP	8,010	DOWN	401,205
Crude stocks	260,525,000	DOWN	2,169,000	UP	4,680,000
Completions	934	UP	131	UP	59
Refinery runs	8,034,000	UP	246,000	UP	350,000
Gasoline stocks	216,059,000	DOWN	2,713,000	UP	9,443,000
Kerosine stocks	21,947,000	UP	479,000	DOWN	566,000
Distillate stocks	85,933,000	UP	2,432,000	DOWN	3,706,000
Residual stocks	38,263,000	DOWN	442,000	DOWN	16,366,000
Four-product stocks	362,202,000	DOWN	244,000	DOWN	11,195,000
Total imports	1,646,400	DOWN	25,800	UP	323,700





Active Rotary Rigs

	5-16-60	5-9-60	5-18-59
Alabama	5	5	7
Alaska	5	5	(†)
Arkansas	11	12	10
Arizona	1	2	2
California	98	96	96
Land	93	91	92
Offshore	5	5	4
Colorado	25	25	47
Florida	1	1	3
Land	1	1	2
Offshore	0	0	1
Illinois	47	48	39
Indiana	6	10	9
Iowa	0	0	3
Kansas	122	117	130
Kentucky	5	4	9
Louisiana	281	273	347
North	40	33	31
S. Inland waters	116	112	150
S. Land	75	75	114
Offshore	50	53	52
Maryland	0	0	0
Michigan	38	35	23
Mississippi	55	57	63
Missouri	2	2	1
Montana	20	14	20
Nebraska	28	23	20
Nevada	0	0	0
New Mexico	113	124	117
New York	1	1	1
North Dakota	15	13	39
Ohio	4	4	3
Oklahoma	171	184	234
Oregon	1	1	0
Pennsylvania	11	12	10
South Dakota	0	0	2
Texas	655	632	775
S. Inland waters	8	11	4
S. Land	177	162	204
Offshore	2	1	0
North	41	43	143
Panhandle	53	49	(*)
East	62	63	(*)
West Central	204	196	267
West	108	107	157
Utah	26	25	25
Washington	0	0	0
West Virginia	3	3	7
Wyoming	62	59	74
Total U. S.	1,812	1,787	2,116
Western Canada	119	92	124
Eastern Canada	2	2	0
Grand total	1,933	1,881	2,240

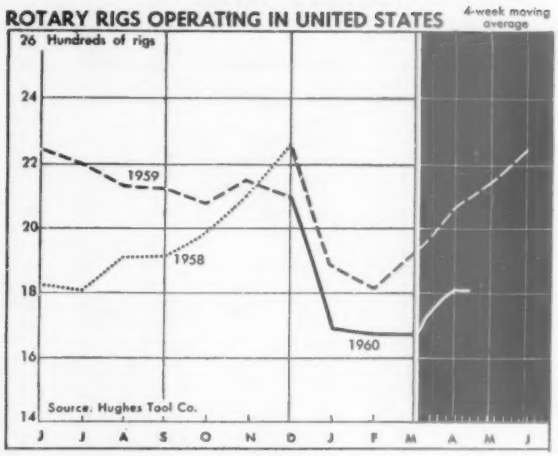
Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported April 4, 1960.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED MAY 14, 1960

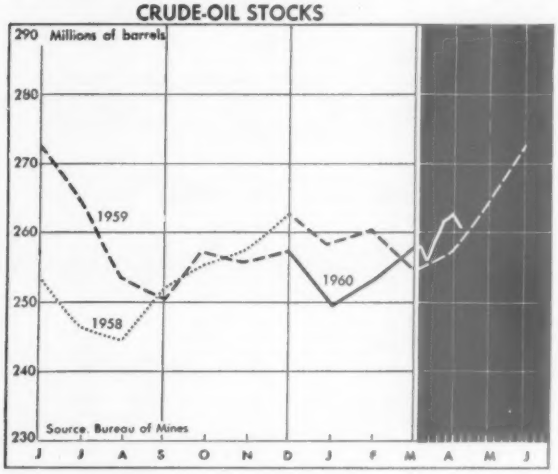
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	0	0	0	0	0	0	0	20	38	0	0	0	0	0	1	5
Arizona	0	0	0	0	0	0	0	6	.....	0	0	0	0	0	6	.....
Arkansas	12	7	0	1	4	0	47,730	223	317	3	0	0	0	3	57	54
California	27	18	0	3	6	0	140,833	481	563	6	0	0	1	5	108	131
Colorado	14	2	0	2	10	0	60,711	252	260	9	1	0	2	6	121	155
Illinois	39	4	0	2	26	7	82,202	691	765	9	0	0	1	8	171	131
Indiana	10	2	0	0	7	1	11,756	318	251	4	0	0	0	4	128	8
Kansas	80	43	0	3	31	3	260,102	1,148	1,504	20	3	0	0	17	374	328
Kentucky	54	40	0	1	13	0	47,614	616	601	6	4	0	0	2	74	64
Louisiana	80	35	8	3	34	0	631,892	1,200	1,288	11	0	0	0	11	181	163
North	27	9	0	1	17	0	106,030	371	454	6	0	0	0	6	74	70
South	45	21	7	1	16	0	442,331	628	692	4	0	0	0	4	94	87
Offshore	8	5	1	1	1	0	83,531	201	142	1	0	0	0	1	13	6
Michigan	16	8	0	2	6	0	63,553	262	201	4	1	0	1	2	81	50
Mississippi	14	8	0	0	6	0	142,677	284	240	4	0	0	0	4	90	110
Montana	10	8	0	0	2	0	63,107	91	103	1	1	0	0	0	40	39
Nebraska	15	8	0	0	7	0	83,252	296	289	4	1	0	0	3	115	132
New Mexico	34	20	2	7	5	0	197,039	669	660	6	1	1	0	4	93	75
West	10	3	0	7	0	0	47,953	225	290	0	0	0	0	0	20	24
East	24	17	2	0	5	0	149,086	444	370	6	1	1	0	4	73	51
New York	0	0	0	0	0	0	0	122	122	0	0	0	0	0	7	12
North Dakota	1	1	0	0	0	0	4,558	107	171	0	0	0	0	0	18	36
Ohio	12	2	0	4	4	2	24,225	383	353	0	0	0	0	0	19	9
Oklahoma	94	51	3	8	29	3	350,087	1,390	2,196	17	1	1	2	13	260	334
Pennsylvania	61	21	0	20	4	16	169,119	246	163	0	0	0	0	0	7	3
South Dakota	0	0	0	0	0	0	0	15	.....	0	0	0	0	0	6	.....
Texas	295	168	10	17	97	3	1,242,168	5,901	7,105	46	3	0	2	41	1,185	1,331
District 1	18	12	0	2	4	0	46,121	421	432	4	0	0	0	4	142	111
District 2	14	2	3	6	3	0	75,593	270	309	3	0	0	1	2	64	87
District 3	27	11	1	0	15	0	184,405	461	417	6	0	0	0	6	86	99
District 4	10	1	0	2	7	0	63,983	430	452	2	0	0	1	1	125	126
East	23	25	0	0	8	0	111,698	443	408	5	0	0	0	5	91	86
District 7-B	33	14	3	1	15	0	116,088	862	1,003	8	1	0	0	7	248	262
West	80	60	2	1	16	1	373,702	1,550	2,200	11	1	0	0	10	245	269
District 9	72	46	0	0	24	2	183,835	1,094	1,339	6	1	0	0	5	158	247
District 10	18	7	1	5	5	0	86,743	370	525	1	0	0	0	1	26	44
Utah	1	0	0	1	0	0	4,450	106	134	1	0	0	1	0	39	37
West Virginia	24	1	0	19	3	1	58,274	282	255	1	0	0	1	0	3	6
Wyoming	26	11	0	1	14	0	120,889	356	295	12	1	0	0	11	150	94
Misc. (Tenn.)	15	3	0	0	12	0	12,090	41	23	15	3	0	0	12	39	18
Total U. S.	934	461	23	94	320	36	3,818,328	15,506	17,897	179	20	2	11	146	3,373	3,402
Prev. week	803	395	26	48	313	21	3,558,822	.....	.....	170	16	2	4	148	.....	.....
Cum. 1960	15,506	7,290	498	1,282	5,985	451	68,187,219	.....	.....	3,373	303	36	109	2,925	.....	.....
Cum. 1959	17,897	9,063	455	1,259	6,647	473	75,220,833	.....	.....	3,402	342	46	107	2,907	.....	.....
Western Canada	18	8	0	5	5	0	105,506	830	863	5	1	0	1	3	253	321

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	5-7-60	4-30-60	5-9-59
Pennsylvania	2,187	2,116	2,481
Other Appalachian	1,793	1,734	1,529
Illinois, Indiana, Michigan	9,823	9,329	8,871
Nebraska and North Dakota	2,810	2,793	2,403
Kansas	10,070	9,989	9,839
Oklahoma	17,968	17,902	15,947
Arkansas	2,108	2,116	1,907
Louisiana	19,868	19,579	18,953
North	3,168	3,246	3,358
South	16,700	16,333	15,595
Mississippi, Alabama, Florida	2,318	2,327	2,365
New Mexico	7,568	7,878	7,844
Texas	110,021	113,436	111,680
East Texas	8,511	8,603	9,099
West Texas	49,495	51,308	53,843
Texas Gulf	19,790	19,991	17,819
Other Texas	32,225	33,534	30,919
Wyoming	17,802	17,600	14,911
Other Rocky Mountain	9,987	9,348	9,040
California	28,319	29,255	33,284
Foreign	†17,883	17,292	14,791
Total	**260,525**	262,694	255,845

*Bureau of Mines. †Includes 4,589,000 bbl. in California.

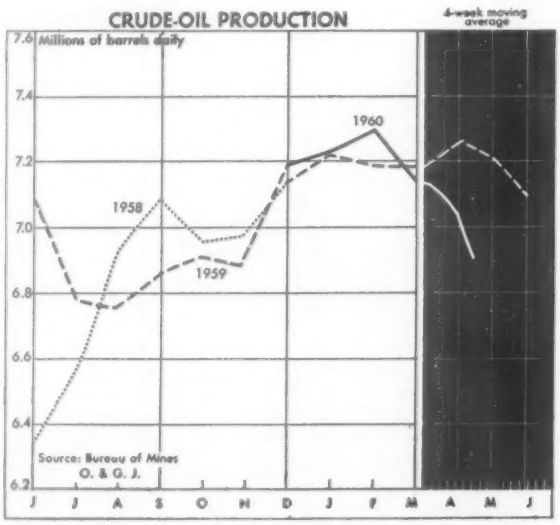
DAILY AVERAGE PRODUCTION FOR WEEK

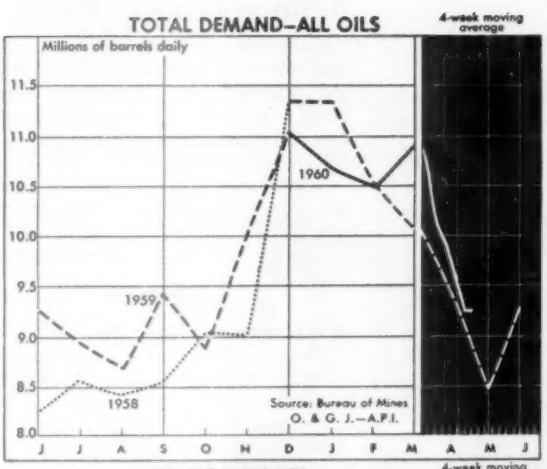
	May 14, 1960 Crude oil	Lease condensate	Total	May 7 total
Alabama	19,250	.....	19,250	19,400
Arkansas	82,750	150	82,900	82,850
California	828,700	.....	828,700	830,600
Colorado	128,600	.....	128,600	129,400
Eastern	42,000	.....	42,000	41,000
Florida	1,000	.....	1,000	1,000
Illinois	209,200	.....	209,200	220,800
Indiana	32,800	.....	32,800	32,600
Kansas	†302,710	.....	†302,710	†287,700
Kentucky	64,400	.....	64,400	64,300
Louisiana	915,750	134,500	1,050,250	1,049,500
North	105,750	6,000	111,750	111,000
South	810,000	128,000	938,500	938,500
Michigan	32,900	.....	32,900	32,700
Mississippi	137,000	3,600	140,600	140,600
Montana	79,500	.....	79,500	81,000
Nebraska	60,500	.....	60,500	62,000
Nevada	100	.....	100	100
New Mexico	293,000	7,000	300,000	300,000
North Dakota	57,600	.....	57,600	59,000
Oklahoma	†523,400	.....	†523,400	†513,200
Texas	2,326,000	89,900	2,415,900	2,415,900
Dist. 1	40,000	3,000	43,000	43,000
Dist. 2	98,000	8,000	106,000	106,000
Dist. 3	306,000	39,000	345,000	345,000
Dist. 4	159,000	18,000	177,000	177,000
Dist. 5	26,000	400	26,400	26,400
Dist. 6	98,000	9,800	107,800	107,800
East Texas field	120,000	.....	120,000	120,000
Dist. 7-B	121,000	175	121,175	121,175
Dist. 7-C	114,000	2,825	116,825	116,825
Dist. 8	944,000	6,000	950,000	950,000
Dist. 9	193,000	1,700	194,700	194,700
Dist. 10	107,000	1,000	108,000	108,000
Utah	90,000	.....	90,000	88,000
Wyoming	336,000	.....	336,000	338,000
Others	‡1,250	.....	‡1,250	‡1,300
Total U. S.	6,564,460	235,150	**6,799,560**	6,791,550
Change from prev. week, up	.....	.....	**8,010**	
Canada	†549,000	.....	†549,000	†451,600

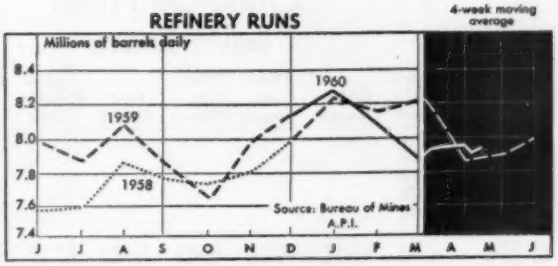
Total U S. prod., January 1-May 14 ..... 961,860,800 bbl.
Same period last year (crude plus cond.) ..... *996,903,300 bbl.

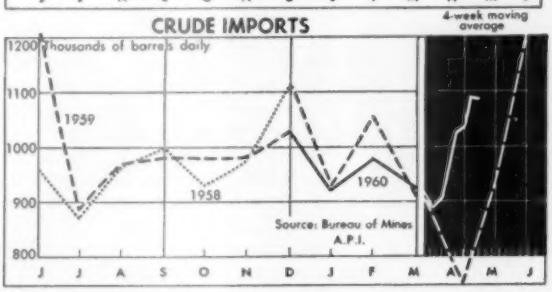
*Includes 25,869,800 bbl. condensate. †Week ended previous Monday. ‡Alaska and South Dakota.

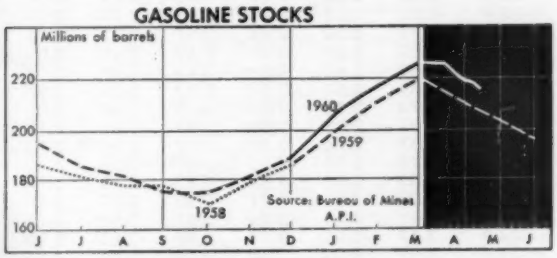
CRUDE-OIL PRODUCTION

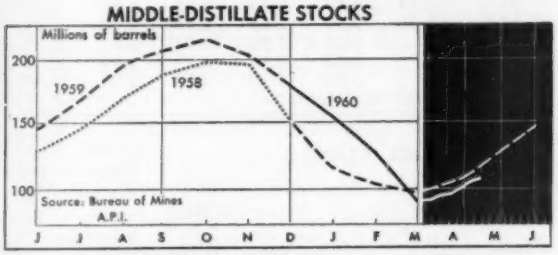


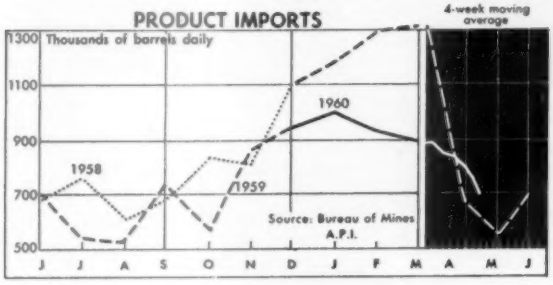


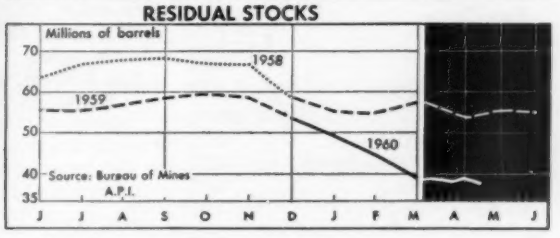












API REFINERY REPORT—MAY 13, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, May 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,123	470.3	42.3	291.4	158.7	46,334	8,228	27,806	9,847	1,014	437.8	19.7	300.4	144.5
Appalachian:														
District 1	98	40.0	2.7	23.4	6.1	5,926	466	2,058	410	89	40.0	3.2	17.4	9.9
District 2	75	50.6	1.3	16.3	8.3	2,972	283	911	335	87	50.2	5.7	15.6	10.5
Ind., Ill., Ky.	1,414	715.7	58.6	279.3	147.9	41,517	4,019	14,812	4,187	1,437	743.8	60.9	272.7	156.8
Minn., Wis., Dak.	118	54.7	8.6	22.6	17.4	6,478	690	3,011	600	103	48.4	4.5	23.7	13.1
Okla., Kans., Mo.	695	363.4	21.3	142.0	18.9	20,694	1,009	6,920	889	713	396.1	8.7	169.4	18.6
Inland Texas	297	206.6	7.6	53.7	22.0	7,211	531	1,652	2,445	283	204.1	8.2	49.7	20.3
Tex. Gulf Coast	1,913	985.3	124.1	411.2	113.9	26,642	2,857	9,584	4,037	1,991	994.0	77.6	478.2	167.6
La. Gulf Coast	691	364.9	49.0	153.3	54.0	12,040	1,513	3,429	1,228	696	367.3	45.2	157.2	48.9
N. La. and Ark.	106	52.3	3.7	21.7	5.7	5,949	551	2,053	126	103	48.3	4.0	23.5	6.7
Rocky Mtn.:														
New Mexico	23	12.6	0.4	4.0	2.1	906	40	172	110	17	10.8	...	3.4	2.4
Other	220	101.8	1.9	53.4	29.7	7,152	219	2,202	964	244	112.6	2.5	52.9	31.5
West Coast	1,261	576.7	35.1	208.0	281.7	32,238	1,541	11,323	13,085	1,119	507.4	4.3	187.5	268.4
May 13, 1960	8,034	3,994.9	356.6	1,680.3	866.4	216,059	21,947	85,933	38,263	7,896	3,960.8	244.5	1,751.6	899.2
May 6, 1960	7,788	3,846.3	287.1	1,662.3	813.9	218,772	21,468	83,501	38,705	.....	.....	.....	.....	.....
May 15, 1959	7,684	3,831.6	260.6	1,762.1	891.4	206,616	22,513	89,639	54,629	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.76	....	....	....	....	....	....	....	....
15-15.9	1.84	....	....	....	....	....	....	....	$1.81
16-16.9	1.92	....	....	....	....	....	....	....	1.86
17-17.9	2.00	....	....	....	....	....	....	....	1.91
18-18.9	2.08	....	....	....	....	....	....	....	1.96
19-19.9	2.16	....	....	....	....	....	....	....	2.01
20-20.9	2.24	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.32	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.39	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:
- Sweet Lake $3.00

Texas:
- East Texas 3.05-3.25
- Conroe 3.23-3.53
- Van 3.08

Pennsylvania Grade:
- Bradford $4.70
- Middle District 4.52
- Southwest Pennsylvania ... 4.25
- West Virginia 4.07
- Buckeye Grade 4.07

Illinois Basin **3.00**

Foreign

Middle East, Persian Gulf (cargoes f.o.b. lifting port):
- Arabian, about 34°, Ras Tanura $1.90
- Iranian, 34.0°-34.9°, Bandar Masur 1.86
- Iranian, 34.0°-34.9°, Abadan 1.81
- Iraq, 36.0°-36.9°, Fao 1.82
- Kuwait, 31.0-31.9°, Mina-al-Ahmadi 1.67
- Qatar, about 41°, Um Said . 2.05

Middle East, E. Mediterranean:
- Arabian, about 35°, Sidon .. 2.29
- Iraq, about 35°, Tripoli, Banias 2.29

Far East (cargoes, f.o.b. Lutong, Sarawak):
- Seria Light, 37° 2.57

Canada:
- Leduc-Woodbend $2.53
- Redwater (Alta.) 2.42
- Smiley (Sask.) 2.18
- Pembina 2.38

Venezuela:
- Cumarebo, 47°-47.9°, Tucupido 3.34
- San Joaquin, 40°-40.9°, Puerto La Cruz 3.08
- Oficina, 35°-35.9°, Puerto La Cruz 2.80
- Tia Juana medium, 26°-26.9°, Amuay* 2.30
- Quiriquire, 16.0°-16.4°, Caripito 2.10
- Lagunillas heavy, flat, Las Piedras* 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

- Gulf-NY, clean (ATRS −15%) $2.42
- ★ Gulf-NY, dirty (ATRS −15%) 2.42
- ★ Carib.-NY, dirty (ATRS −60%) 1.10
- PG-UK, dirty (Scale −67.5%) (21s. 10d) 3.05

★ Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):
- Regular (91 octane) .. 10.50-10.75
- Premium (99 octane).. 13.00-13.50
- Natural gasoline (26-70) 4.5
- Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements):
- Regular (90 octane) .. 10.00-10.25
- Regular (92 octane) .. 10.25-10.50
- Premium (98 octane).. 11.00-11.50

California (rack) Los Angeles):
- Regular (88 octane) .. 11.65-12.15
- Premium (94 octane) 12.65-13.15
- Premium (100 octane) 14.00-14.65

Caribbean area (cargoes):
- Regular (87 octane) .. 10.00
- Premium (97 octane) 11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):
- Kerosine 42-44 ..... 9.00-9.50
- Diesel oil (58 d.i. and above) 8.75-9.25
- Distillate No. 1 ..... 8.75-9.25
- Distillate No. 2 ..... 7.75-8.25

Gulf Coast (cargoes):
- ★ Kerosine 41-43 ..... 8.875-9.00
- ★ Distillate No. 2 ..... 7.875-8.00

New York Harbor (barges):
- Kerosine 41-43 ..... 9.8-10.3
- Distillate No. 2 ..... 8.8- 9.3
- Diesel fuel, 48-52 d.i. .. 9.1- 9.6

Caribbean area (cargoes):
- Distillate No. 2 ..... 8.00

Residual Fuel (Bbl.)

Mid-Continent (Group 3):
- Residual fuel (max. 1% S) $1.70-1.80

Gulf Coast (cargoes):
- Bunker C fuel 2.10-2.25

New York Harbor (barges):
- Bunker C fuel $2.47

Caribbean (cargoes):
- Bunker C $2.10

California (rack):
- Bunker C fuel, Los Angeles $2.15

★ Denotes change from previous week.

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FOR SALE—One (1) 13⅜" L.R.—No. 51-3 Landis Receding Chaser Pipe threading and cutting off machine complete with standard auxiliary equipment, No. 13⅜" receding No. 50-2 diehead-API taper thread for pipe 8⅛" to 13⅜"—15 HP motor drive. Originally purchased in 1943, total operating time 3½ years, replacement cost is $20,000.00 Complete details upon request. Submit offers to K. M. Miller, Rohm & Haas Company, 222 Washington Square, Philadelphia 5, Pa.

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10,000 ft. 14" O.D. Used Lapweld Pipe .281 Wall—41.21 # per ft. Plain end—machine cleaned #1 and Good #2 grade

Single Random Length

Wire, Write, or Phone

COLUMBUS STEEL SUPPLY
1000 BONHAM AVE. • AX 4-4461
COLUMBUS, OHIO

LIQUIDATION

AMOCO REF. DESTREHAN, LA.

BOILERS, 70,000 #/hr. & 80,000 #/hr. 450 Psi.
HORTONSPHERES, 5,000 & 10,000 bbl.
EXCHANGERS, 78 to 2,800 sq. ft.
TOWERS, 3 ft. to 7½ ft. diameter.
VESSELS, 2 ft. to 10 ft. diameter.
FURNACES, 26 MM BTU/hr.
TURBO EXHAUSTERS, 15,360 & 17,000 CFM.
CENT. PUMPS, 15 to 7,000 GPM.
TURBINES, 5 to 290 HP.
TANKS, 1,000 to 29,000 bbl.
COMPRESSORS, (IR) XVG—4 & XVG—2.

BRILL EQUIPMENT COMPANY
DESTREHAN, LA.
TEL. NORCO 6571
55-53 JABEZ ST. NEWARK, N. J.
4101 SAN JACINTO, HOUSTON, TEXAS

FOR SALE EQUIPMENT

FOR SALE OR LEASE: Three (3) large perforating trucks complete with 16,000' of 7/16" single conductor line. These units are ready for the field. Box L-814, The Oil and Gas Journal, Tulsa, Oklahoma.

1—128CH EMSCO used pumping unit 461,000# peak torque complete with M-34 Fairbanks engine, unit and engine in excellent condition, Price $3,800.00. 1—8' x 28' B.S. & B., used, Type F Heater complete with all fittings, Price $1,800.00. Above equipment located in Oklahoma, if interested, contact: Rex Petroleum and Equipment Company, Tulsa, Oklahoma. Phone LUther 4-6339 or LUther 5-8551.

—PIPE—

2,000,000 ft.	2"	3.50# to the ft.
1,000,000 ft.	3"	7.70#
1,000,000 ft.	4"	10.98#
500,000 ft.	6"	19.80#
200,000 ft.	8 5/6"	28#
400,000 ft.	10¾"	35#
75,000 ft.	12¾"	40#
10,000 ft.	16"	42#

All No. I Grade plain end and cleaned.

INDIANA-OHIO PIPE CO.
P. O. Box 5412 Shep. Sta.
Columbus 19, Ohio
Phone CL 3-5527

NEW CROLOY 5 HEATER TUBES

Priced at ½ New Cost

Must Move at Once

14—3¾"	x ⅜"	wall x 44' long
63—4"	x ⅜"	wall x 26' long
10—4"	x ⅜"	wall x 32' long
50—4"	x ½"	wall x 32' long
3—5"	x ½"	wall x 42' long
42—6"	x ½"	wall x 27' to 47' long

HEAT & POWER CO., INC.
60 E. 42nd St., N. Y. 17, N. Y.
310 Thompson Bldg., Tulsa 3, Okla.

FOR SALE

WILSON-TITAN

The following equipment was in first class working order before we broke up the rig.

DRAW WORKS
(No motors. Formally had three LRO Waukesha motors)
COMPOUND
GEAR-BOX ASSEMBLY
PARKERSBURG BRAKE
(Newest model)
IDECO
27-in. Rotary Table

ROCKTON DRILLING CORP.
14 Wood St., Pittsburgh 22, Pa.
Phone GRant 1-3200

FOR SALE EQUIPMENT

3-CLARK GAS COMPRESSORS
500 H. P., Model RA-5
14" x 14", 300 RPM With
17" x 14" VTH Cylinders
COMPLETE-EXCELLENT CONDITION
HEAT & POWER CO., INC.
60 E. 42nd St., N. Y. 17, N. Y.
310 Thompson Bldg., Tulsa 3, Okla.

LIQUIDATION

at ESSO REFINERY Balto., Md.

10,000 BBL/DAY FLUID COKER COMPLETE—NEW 1955 STILL ON FOUNDATIONS

TOWERS

10' x 145'—	125 PSI 50 trays
9'6" x 121'—	325 PSI 30 trays
8'6" x 103'—	165 PSI 24 trays
7'0" x 82'—	75 PSI 30 trays
6'0" x 80'—	300 PSI 30 trays
4'0" x 44'—	150 PSI 12 trays
3'6" x 38'—	400 PSI 12 trays
2'6" x 52'—	360 PSI 22 trays
2'2" x 57'—	85 PSI 4 trays

HEAT EXCHANGERS—CONDENSERS

Steel Tube	7,500 to 100 sq. ft.
Adm. Tube	3,500 to 236 sq. ft.
Cu Ni Tube	2,330 to 308 sq. ft.
S. S. Tube	1,000 to 170 sq. ft.

CLARK COMPRESSORS
RA5 GAS ENGINE 2VTH 17" x 14" CYL

BLOWERS—28,000 CFM @ 17 PSIG
11,880 CFM @ 11 PSIG
INSTRUMENTS—Controllers, Recorders, Indicating and Transmitting
MOTORS—10 HP to 500 HP XP
PIPE CHROME—3¾" to 14" OD
PUMPS—Hot Oil, Steam, Centrifugal
REACTOR—8' x 32'6" OA
REBOILERS—2,700 to 450 sq. ft.
TRANSFORMERS—5 KVA to 333 KVA
VALVES—Diaphragm, Butterfly Slide and Pressure Regulating
VESSELS PRESSURE—3' to 12' Dia.

PETRO CHEM FURNACE
1.9 MILLION BTU NEW 1949

WRITE FOR COMPLETE CATALOG

HEAT & POWER CO. INC.
60 East 42nd St., New York 17, N.Y.
310 Thompson Bldg., Tulsa 3, Okla.
Box 5203, Baltimore 24, Maryland

FOR SALE EQUIPMENT

A LIMITED quantity Westinghouse 10 HP, 1150 RPM, 3-Phase, 60 cycle, 220/440 volt, high starting torque, totally enclosed fan cooled oil well pumping motors reconditioned in our shop, $195.00 each 1 to 4 motors, $175.00 each 5 to 10, $155.00 10 or more, FOB San Antonio, Texas, Loyd Electric Co. Inc., Phone CA 7-1309.

FOR SALE: Four Diesel Powered Rotaries complete, Special Built 2,500 ft., 2000 Mayhew, 1500 Failing Special, 1500 Winter Weiss Special, Also, Spudders, 83 Special Tandem, 72 Full Trailer, 71 Truck mounted Speedstars, and #10 Ideco. Star Drilling Supply Co., Chanute, Kansas.

1 BUCYRUS—ERIE 36L Spudder, late model. Rig complete with tools and equipment. Cassel Drilling Co., Inc., Dumas, Texas. Phone WE 5-5019 or WE 5-4369.

PARKERSBURG PUMPING unit SC-10 stroke from 48" to 120". Polish rod load 20,000#. Bellaire Pipe & Supply Co., 8020 Lyons Ave., OR 4-2763, Houston 29, Texas.

8,350 ft. 2⅞" EUE seamless 8R thread, used tubing: 60 cents per ft. 3,000 ft. 2⅞" ditto, 10 thread: 55 cents per ft. Located Elk City, Okla. 1,200 ft. 4" O.D. full hole drill pipe: Located Blackwell, Okla. Carman Supply Co., Phone RIverside 2-3502, 1008 E. 36th St., Tulsa.

FOR SALE: Four (4) 25,000 barrel steel storage tanks 70' dia. x 36' high; and two (2) 35,000 barrel steel storage tanks 78' dia. x 40' high. Used for alcohol storage. Location Louisville, Ky. Complete details upon request. Negotiate with K. M. Miller, Rohm & Haas Company, 222 Washington Square, Philadelphia 5, Pa.

2—HALL SCOTT "Defender" 2269 V-12 with Marine Reverse Gear Box and Clutch Bore 5¾" stroke 7 Cu. In. Displacement 2181 Compression Ratio 7:00-1 at $1,500. Each. Original cost to government $18,000. These motors are like new. Phone FR 9-5131, Seguin, Texas. Write Texas Acidizers, P. O. Box 47, Seguin, Texas.

FOR SALE GAS COMPRESSORS: Two Type X Twin Bessemers, three Type X Single Bessemers, 17" power cylinders, overhead exhaust. Two Type 80 Coopers. Alfred B. Kern, 305 Kennedy Bldg., Tulsa, Oklahoma.

FOR SALE

The following used equipment located near Bowie, Texas:

32,000 ft. 5½" O.D.; 15.50 lb.; range 2; J—55; smls. steel casing
28,000 ft. 2⅜" O.D.; 4.70 lb.; range 2; J—55; EUE tubing
17,000 ft. ¾" sucker rods
12,000 ft. ⅞" sucker rods
1—Ideco type S221 pumping unit w/ZC739 Fairbanks & Morse engine
1—United Supply Co. type 302 pumping unit w/Continental C-96 engine
1—Parkersburg type 64 HGS pumping unit w/ZC739 Fairbanks & Morse engine
1—American T-17 pumping unit
1—BS&B 6' x 20' heater-treator
1—Hanlon-Waters 3' x 12' oil and gas separator
4—210 Bbl. steel welded tanks w/rigging & connections
1—150 Bbl. steel welded tank

P. O. Box 2904, Dallas, Texas
Phone RIverside 2-3786

SOHIO PETROLEUM COMPANY

Patoka Water flood properties located near Patoka, Illinois. Properties include 18 water flood units and leases.

Additional information may be obtained by writing:

Box 416
or calling
2-4701 Centralia, Illinois
Attn: C. A. Keller

FOR SALE EQUIPMENT

NO. 45 STAR SPUDDER on rubber. 145 H. P. Hercules motor (good) Tools 15 in. down, ready to drill. Inventory on request. Elk Drilling Co. Inc., Howard, Kans.

MY SET OF Illinois, Indiana, Kentucky completion cards complete from beginning of scout check through January 1st, 1960 on 16 millimeter microfilm, over 95,000 cards. P. O. Box 1531, Denver, Colorado.

HELP WANTED

TENNESSEE GAS AND OIL COMPANY

a division of

TENNESSEE GAS TRANSMISSION COMPANY

has a career opportunity for an

OPERATIONS FOREMAN

for its drilling and production operations in Lafayette, La. Must have degree in Engineering with at least 6 to 8 years offshore drilling experience or 4 to 5 years offshore drilling experience combined with 2 to 4 years drilling experience in South Louisiana. Send complete resume including educational background, work experience and personal history to:

EMPLOYMENT DEPARTMENT
P. O. Box 2511, Houston 1, Texas
(All replies will be held in confidence)

REFINERY INSTRUMENT Engineer with experience on varied type instruments. Give resume of experience, education and salary expected. Box L-843, The Oil and Gas Journal, Tulsa, Oklahoma.

FOREIGN—DOMESTIC Employment Oil, Chemical, Industrial. Write for details without obligation. Accredited Personnel Services, P. O. Box 6006, New Orleans 14, La.

NEW OIL JOB Directory, foreign and domestic, showing where to apply for jobs. 500 selected producing, refining, butane and pipeline companies. Nationwide, $5.00 cash. List Aircraft mechanics' schools—$3.00. OIML Co., Box 2603, Tulsa, Oklahoma.

UNUSUAL OPPORTUNITY

Technical service and sales work for sanitary or petroleum engineer with experience in water flooding. Salary and commission. Write fully, including recent photograph, to:

BUCKMAN LABORATORIES, INC.
Memphis 8, Tennessee.

Stops corrosion problems in refineries, oil fields, distribution equipment, filling station underground pipe installations, etc. Write for details. Free sample. GALV-WELD PRODUCTS, Dept. OGJ, P. O. Box 1303, Bradenton, Florida.

RESEARCH TECHNICAL SERVICE

A position in Petrochemical Research offers exceptional opportunities to a man interested in research and technical sales. We need a man who will expand our background of chemicals in oil field production. This man should have some oil field experience and a definite interest in the development of chemical products. Success in this position depends on ability to promote good ideas, both in research and sales.

Applicant should have college degree in chemistry or engineering and up to five years experience. Send resume of background to:
Personnel Relations Dept. No. 3
CONTINENTAL OIL COMPANY
Ponca City, Oklahoma

FOR SALE EQUIPMENT

18" AND 20" good used pipe. Very attractive prices. Contact: The Tri-State Pipe Co., Bellaire, Ohio. Telephone OR 6-1452.

EQUIPMENT WANTED

USED PRI MODEL 111-C portable scintillator crystal dia. 2¼" wt. 8½ lbs. or other similar. P. O. Box 5315, Tulsa, Okla. Tel. RI 2-8271.

HELP WANTED

TRANSLATORS, Proven ability to translate technical material into fluent English essential. Attractive full time or free-lance arrangement. All languages of interest, particularly Russian. Send resume to: A•T•S, Inc., Drawer 271, East Orange, N.J.

SALES ENGINEER with Station Manager experience. Must be skilled in acidizing, fracturing, cementing and oil field services. Salary comensurate with capacity to produce. Contact Allied Services, Inc., Clark Core, P. O. Box 47, Seguin, Texas. Phone FR 9-5132.

OPPORTUNITIES IN RESEARCH

Immediate openings at all levels for qualified personnel in petroleum production research. Experienced personnel or those with advanced degrees in engineering, chemistry, physics, or mathematics will be considered. Problems under investigation include secondary recovery, reservoir analysis, fluid flow, well completions, cements, and mathematical analysis. Please send resume to: Cities Service Research and Development Company, 920 East Third Street, Tulsa, Oklahoma.

SITUATIONS WANTED

ENGINEER AND PRODUCTION Superintendent: Experienced in all phases of production and qualified as expert in secondary recovery 14-years experience in Mid-Continent. Box L-847, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER. P.E., M.S. Registered, 28, 5 years experience diversified, waterflood project supt., deal and evaluation work, employed as production supt. for independent in Venezuela. Preference for Latin America, but will consider other opportunities. 2501 Boyd, Ft. Worth, Texas.

PRODUCTION SUPERINTENDENT, 20 years experience, completions, workovers, secondary recovery and administrative. Age 43, presently employed, desire change. Box L-835, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION SUPERVISOR—12 years experience one company. Production foreman, reservoir tester, plant supervisor, pipeline, corrosion engineer, gas measuring testing, gasoline plant design drafting. ICS Petroleum Engineer. P. O. Box 983, Perryton, Texas.

OIL PRODUCTION man, 18 years experience. Returned from 28 months foreign service as production supervisor. Desires production job in states. Married and 40 years of age. P. O. Box 1271, Maud, Oklahoma. Phone 5641.

SITUATIONS WANTED

MANAGEMENT GRADE engineer or production supervisor, registered professional engineer, presently employed. Minimum salary $15,000. Box L-845, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM PRODUCTION ENGINEER; age 41, 11 years experience with major in East Texas and Gulf Coast. Box L-828, The Oil and Gas Journal, Tulsa, Oklahoma.

LAND OR CONTACT job wanted with progressive company. 4½ years scouting experience, good knowledge land work, drilling deals, oil and gas law. BBA degree, 4609 Parkdale Dr., Apt. 3, Corpus Christi, Texas.

GEOLOGIST, 33, MS., 5½ years subsurface experience with major oil company in South America. Desires position with domestic independent or major. Box L-825, The Oil and Gas Journal, Tulsa, Oklahoma.

ADMINISTRATIVE secretary, 39, single, 10 years experience with major Venezuelan oil producer; desires relocate Latin America, but will consider other foreign employment. Box L-753, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST-ENGINEER—Excellent experience in exploration, drilling and completion. Independent past three years. Gone busted. Seeking retainer or contract work. Guarantee satisfaction or no pay. Box L-852, The Oil and Gas Journal, Tulsa, Oklahoma.

RETIRED TOOL pusher desires position with independent company, drilling contractor, or service company. Thirty-eight years experience with Major oil company in Gulf Coast operations, including ten years offshore. Fifty-nine years of age, good physical condition, and qualified in all phases of drilling or producing operations. Box L-850, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER AND PRODUCTION superintendent experienced in all phases of production and qualified as expert in secondary recovery. 14-years' experience in Mid-Continent, Box L-851, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM Engineer, 31, married, no children. Experienced in drilling, workovers and production. Desires position with agressive independent, foreign, domestic or both. Willing to travel. Presently employed. Box L-849, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS OPPORTUNITIES

DRILL YOUR OWN WELLS: Will rent on rental-purchase basis, or sell, complete Rotary Rig in good condition, equipped to drill to 7,500'. Located in North Texas. Would take stocks or bonds in on sale. Box L-848, The Oil and Gas Journal, Tulsa, Oklahoma.

FINANCIAL Contacts, Underwriters, Private Brokers reached. No shopping. Confidential. Send details to Consultant—817—51st Street, Brooklyn, N. Y.

CRUDE OIL purchasing Co. sales to major pipeline. Waste oil recovery. Lake Texoma, Oklahoma. Write Box 187, Kingston, Oklahoma.

RELIABLE OPERATOR offers interest in drilling deal at $300 per eighth. Semi-proven acreage. Direct deal. Completion at actual cost. Box L-833, The Oil and Gas Journal, Tulsa, Oklahoma.

NEW PRODUCTS WANTED—Well-established, responsible company with complete facilities for developing, manufacturing and marketing oil field equipment is seeking new or improved products, preferably patented or patentable to add to its presently well-known line. Royalty basis or outright purchase. Initial submission should identify product and general use without revealing engineering and confidential detail. Submissions will be handled promptly and confidentially. Box K-994, The Oil and Gas Journal, Tulsa, Oklahoma.

NOTICE FOR PROPOSAL OF NATURAL GAS FRANCHISE

Proposals for an exclusive natural gas franchise will be accepted in the office of the City Clerk of the City of Wilton Manors, Florida, 524 N. E. 21st Court, Wilton Manors, Fort Lauderdale, Florida, until 8:00 o'clock P. M. on Tuesday, July 12, 1960.

BUSINESS OPPORTUNITIES

CAN YOU SELL LOST CIRCULATION MATERIAL?
HAMMONS PRODUCTS COMPANY
Manufacturer of 'OIL PATCH' brand
ground, true native, eastern black walnut shells
(Licensed by Pan American Petro. Corp. under patents granted in the U.S.A., Canada and Mexico) is interested in setting up dealer stock points with aggressive, proven individuals and/or companies on consignment or net sale basis.
IF YOU OR YOUR COMPANY CAN SELL THE BEST,
WE CAN FURNISH IT!
All inquiries treated in confidence. WRITE, WIRE OR PHONE—**HAMMONS PRODUCTS COMPANY** c/o Joe Holman, Director of Industrial Sales, 412 North Sterling St., Lafayette, Louisiana, Ph. CE 2-3158.

SUCCESSFUL BUSINESS servicing, repairing and rebuilding oil field and industrial engines, for sale by owner-operator. Rebuilt engines, parts stock, service truck, and shop equipment priced to sell. 64-year old owner retiring. McCoy Industrial Engine Service, Cortez, Colorado. LO 5-7623.

LEASE AND DRILLING BLOCKS

WILL LOCATE AND LEASE your shallow drilling blocks in Central Kentucky. Box 135 Horse Cave, Kentucky. Phone evenings State 6-6314.

WILL DEAL 32½ A. lease. Direct offset to discovery well, where pipe has been set. 3 miles from production. Clark County, Illinois. W. V. Tarman—Martinsville, Illinois.

EAST TEXAS leases: $5 acre up, near new Smackover strike and other sands active. Stand investigation for profits. References: E. M. Adams—Marshall, Texas.

MONTGOMERY COUNTY, Mississippi on top of the Kilmichael Dome offers 4 likely oil sands at less than 3,500 feet. Surface, magnetomer and seismograph confirms 31-19-7 drill site between Highway 82 and C&G RR. Will block leases at $1.50 an acre on HIGHS. Gusher, 1369 Court, Memphis 4, Tenn.

FOR SALE: 800 A. block Oil & Gas leases, offsetting production; Saline County, Kansas. $10 acre and a ⅛ override. Box L-834, The Oil and Gas Journal, Tulsa, Oklahoma.

! ! OIL ! !
Proven Lease and Drilling Blocks located Illinois, Indiana, Kentucky and Ohio. Sell all or ½ interest in each. Producing and non-producing royalties, minerals and overrides. Attractive prices.
H. L. RITTER
Box 384, Olney, Illinois
Phone EXpress 2-7731 or 2-4691

Have several Drilling Blocks in Vinton, Jackson, Gallia, Lawrence, Hocking County, Ohio, also West Virginia acreage to farm out. Capital needed to drill, offset production.
DAVID LAW
717 Union Trust Building
Parkersburg, West Virginia
Phone HU 5-6446

—WANTED—
OIL AND GAS RESERVES
By diversified public corporation listed on American and Toronto Stock Exchanges. Wish to purchase either fully developed producing properties or partially developed properties with proven locations. Also interested in acquisition of small producing companies by merger. Submit complete information to:
Dr. Robert V. West, Jr.
2000 National Bank of Commerce Bldg.
San Antonio 5, Texas.
THE TEXSTAR CORPORATION

LEASE AND DRILLING BLOCKS

280 ACRES OIL and gas leases, Montgomery County, Kansas in proven areas. Will begin drilling soon, have ⅞ for $620 per ⅛. All funds escrowed. Subject to prior commitments. Further information available. Write S. & M. Drilling & Production Co., P. O. Box 98, Cherryvale, Kansas.

$250,000.00 REWARD FOR the first oil well in Georgia. I have the Lease Blocks and need heavy duty slim hole, truck-mounted rotary rig to drill the test wells with. All leases are located on well defined structures. Gravity meter and Magnatometer surveyed highs. Gas and oil seepages and good surface geology. If you have the rotary equipment or finance available and would like an opportunity to join me in this exploration work, contact me at once. This is an opportunity for financially interested persons only or one with the equipment to do the drilling. Contact T. R. Davis, Dixie Drilling Co. Vidalia, Georgia.

3,500 ACRES $3 per acre. Lawrence County, Ky. in midst of new gas play. Ten year leases in first year, ⅛ override, no drilling committment, 50 cents per acre annual rental. U. S. Andersen, 8350 Santa Monica Blvd., LA 46.

PROSPECTIVE OIL Land: Suitable townsite acreage in fee, E/35 acres, Sec. 16, Block JKL, PSL Survey, Hudspeth County, Texas, at intersection U. S. Highway 62 and F. M. 1437 Highway, south of Dell City, Texas. Write quickly, Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

KENTUCKY OIL LEASES near production in Adair, Russell, Cumberland, Metcalf and Green Counties. Write Box L-819, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS SERVICE

DELAWARE CORPORATIONS formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

ROYALTIES

NOTICE INVESTORS, income producing oil, gas-distillate royalties for sale. Ogden Oil Company. P. O. Box 490, Taylor, Texas.

HIGHEST PRICE paid for income royalties, overrides, oil properties. A. S. Berry, 109 Midco Bldg., 302 South Cheyenne, Tulsa, Oklahoma.

MONEY RAISING

NEED CAPITAL to drill 160 acres, direct offset to new Bartlesville Sand well. Primary production 775-ft. deep. Reply P. O. Box 8, Cherryvale, Kansas.

ADDRESS WANTED

$5.00 WILL BE paid for address of R. L. Cranfield. Write Richard D. Hatch, P. O. Box 1206, Aransas Pass, Texas.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that 10,474.20 acres of land in 91 parcels, within the known geologic structures of various fields in Big Horn, Campbell, Carbon, Hot Springs, and Weston Counties, Wyoming, are offered for competitive oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre at 2:00 P.M., MST, July 6, 1960, when bids will be opened. Full details of the offering, and how and where to submit bids, may be obtained from the Land Office, Cheyenne, Wyoming. Arvin H. Olswold, Chief, Minerals Adjudication Unit.

SOUTHWEST TEXAS

(Continued from page 165)

Marcus Rosenwasser, 11 miles northeast of Edna at East Cordele. Jesse Pierce Sur., A-253. IPFAOF 4 M.M.c.f.d., dry gas, SITP 1,215 psi. 3,175-ft. Frio pay 3,170-77 ft. TD 3,626 ft. New gas discovery.

H. H. Howell 2-B O. E. McNeil, 6 miles northwest of Edna in E. Collier area. Jno. Andrews Sur., A-4. IPF 68 BOPD, 7/64-in. choke, TP 500-475 psi., 21.6°, GOR 905:1. Catahoula 2,459-68 ft. TD 2,618 ft. New oil discovery.

Victoria County:

John C. O'Leary 1 J. J. Murphy, 13 miles south of Victoria on Carlos & Rafael de la Garza Sur., A-46. IPAOF 55 M.M.c.f.d., STP 2,205 psi., 58°, GLR 135,000:1. 5,640-ft. Frio 5,643-51 ft. TD 6,100 ft. New gas-condensate discovery.

SOUTH TEXAS

Duval County:

Blanchard, Pearl & Camp 1 Hurizar, 9 miles west of San Diego in Sec. 19, H&GN Sur., A-315. IPF shut in gas find. Hockley pay 3,960-61 and 3,963-65 ft. TD 4,555 ft.

WEST TEXAS

Hockley County:

R. H. Fulton & Co. 1-2 Williams, 7 miles south Levelland in Lab. 2, Lge. 33, Baylor CSL Sur. IPP 145 BOPD, 25% water plus, 28°, Clear Fork 6,320 to 6,500 ft. TD 6,625 ft.

Howard County:

J. C. Barnes Oil Co. 1 Conrad, 3 miles northeast of Vincent, Sec. 67, Blk. 20, Lavaca Nav. Co., Sur. IPF 181 BOPD, 14/64-in. choke, 46.7°, GOR 1468:1, TP 720 psi. Penn. reef 7,353-7,408 ft. TD 7,411 ft. New oil discovery.

Terrell County:

Humble 1 Annie Spencer, 10 miles southwest of Sheffield in Sec. 68, Blk. B-2, CCSD&RGNG Sur. IPCAOF 7,700 M.c.f.d., Strawn 11-371-89 ft. TD 16,620 ft. New gas discovery 14 miles northwest of Brown-Bassett field.

LEGAL

SALE OF OIL AND GAS MINING LEASES TRIBAL AND ALLOTTED INDIAN LANDS SALE NO. 11. Department of the Interior, Bureau of Indian Affairs, Crow Indian Agency, Crow Agency, Montana. Sealed bids will be received until June 13, 1960, 2:00 o'clock, P.M., Mountain Standard Time, and opened at that time in the office of the Crow Indian Agency, Crow Agency, Montana, for the leasing of 15,319.94 acres of tribal land located in T. 5 S., R. 26 E., T. 5 S., R. 27 E., T. 6 S., R. 26 E., T. 5 S., R. 25 E., and 19,744.17 acres of allotted lands located in T. 5 S., R. 26 E., T. 6 S., R. 26 E., T. 5 S., R. 25 E., Big Horn County, Montana, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of Crow Indian Agency, at Crow Agency, Montana.

LEGAL

SALE OF OIL AND GAS MINING LEASES TRIBAL INDIAN LANDS SALE No. 10. Department of the Interior, Bureau of Indian Affairs, Crow Indian Agency, Crow Agency, Montana. An oral auction will commence at 2:00 o'clock P.M., Mountain Standard Time, June 13, 1960, at the Office of the Crow Indian Agency, Crow Agency, Montana, for the leasing of 5 units of unsurveyed tribal lands comprising approximately 3,200 acres more or less in T. 6 S., R. 25 E., Big Horn County, Montana, for oil and gas mining purposes. The details of the lease offering and information may be obtained by addressing the inquiry to the Superintendent of Crow Indian Agency, Crow Agency, Montana.

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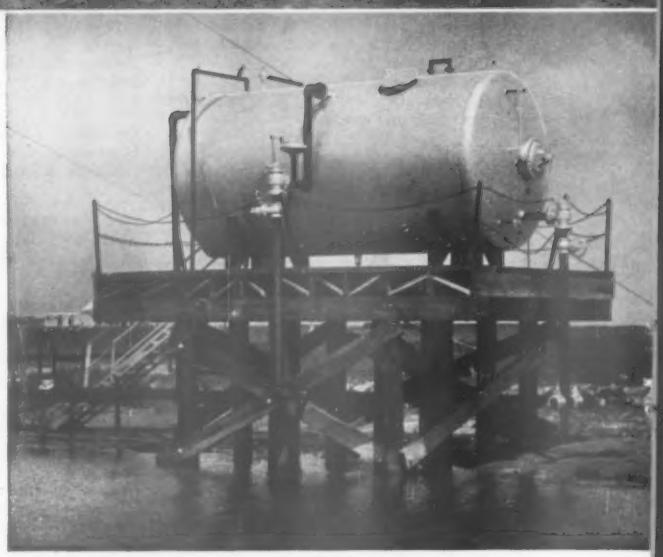

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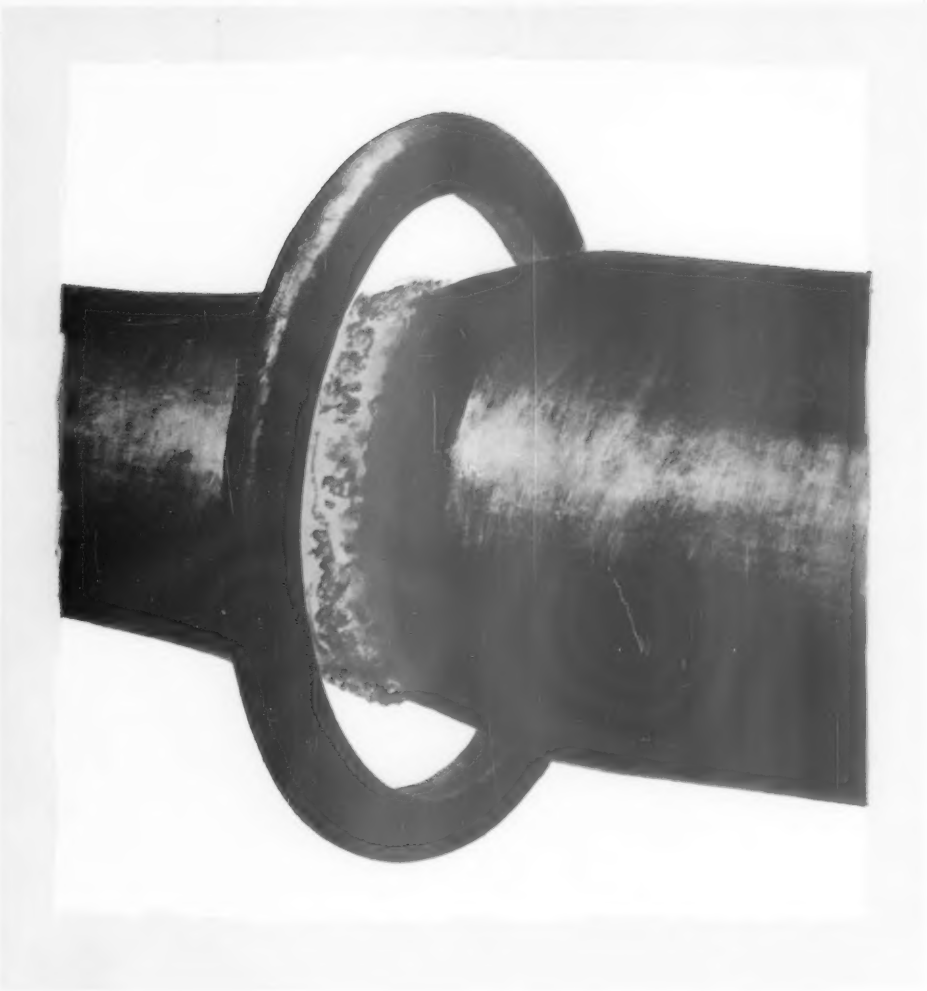

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